Service Manual

AvantGuard™
Electric Bed

Hill-Rom®
A HILLENBRAND INDUSTRY

QD1787

AvantGuard™ Electric Bed Service Manual

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Chapter 1 Introduction

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Purpose

This manual provides requirements for the AvantGuard™ Electric Bed normal operation and maintenance. It also includes a parts list (in chapter 5) for ordering replacement components.

Audience

This service manual is to be used only by facility-authorised personnel only. Failure to observe this restriction can result in severe injury to people and serious damage to equipment.

Organisation

This manual contains seven chapters.

Chapter 1: Introduction

In addition to a brief description of this service manual, chapter 1 also provides a product overview.

Chapter 2: Troubleshooting Procedures

Repair analysis procedures are contained in this chapter. Use these procedures to gather information, identify the maintenance need, and verify the effectiveness of the repair.

Chapter 3: Theory of Operation

This chapter describes the application of the mechanical and electrical systems employed in this product.

Chapter 4: Removal, Replacement and Adjustment Procedures

Chapter 4 contains the detailed maintenance procedures determined necessary in chapter 2.

Chapter 5: Parts List

This chapter contains the warranty, part-ordering procedure, and illustrated parts lists.

Chapter 6: General Procedures

Cleaning, preventive maintenance, and other general procedures are described in this chapter.

Chapter 7: Accessories

A list of additional products, that can be used in conjunction with the AvantGuard™ Electric Bed, is available in chapter 7. Installation procedures for these accessories are also included.

Typographical Conventions

This manual contains different typographical conventions designed to enhance the readability and understanding of its content. These conventions are listed below:

- Standard text — used for standard text throughout the manual.
- **Boldface text**: emphasizes a word or phrase.
- **NOTE**: sets apart special information clarification of an important instruction.
- The symbol below highlights a WARNING or CAUTION

Figure 1-1. Warning or Caution

  - A WARNING identifies situations or actions that may affect patient or user safety. Disregarding a warning could result in patient or user injury.
  - A CAUTION points out special procedures or precautions that personnel must follow to avoid equipment damage.
- The symbol below highlights a CAUGHT HAZARD WARNING:

Figure 1-2. Caught Hazard Warning

- The symbol below highlights an ELECTRICAL SHOCK HAZARD WARNING:

Figure 1-3. Electrical Shock Hazard Warning

Acronym List

There are several acronyms associated with the AvantGuard™ Electric Bed. For a list of acronyms, see table 1-1 on page 1-6.

Table 1-1. Acronym List

Acronym	Definition
CPR	Emergency release of head section for Cardio-Pulmonary Resuscitation
CU	Control Unit (control pendant or control panel on a flexible arm)
DMM	Digital Multimeter
EOT	End of Travel
F-Col	Foot Hilow Column
BM	Brake Microswitch
g/y	Green/Yellow
H-Col	Head Hilow Column
HL	Hilow
HS	Head Section
HSA	Head Section Adjustment
IVP	I.V. Pole
LCU	Lateral Caregiver Unit
LED	Light Emitting Diode
FS	Foot Section
NC	Normally Closed
NO	Normally Open
PAT	Portable Appliance Tester
P/N	Part Number
PSU	Power Supply Unit
RAP	Repair Analysis Procedure
RHS	Retractable Head Section
S/A	Sub-Assembly
SS	Seat Section
TP	Test Point
Tr/Rev Tr	Trendelenburg/Reverse Trendelenburg
TS	Thigh Section
VAC	Volts Alternating Current
VDC	Volts Direct Current

Introduction

Overview

The AvantGuard™ Electric Bed comprises:

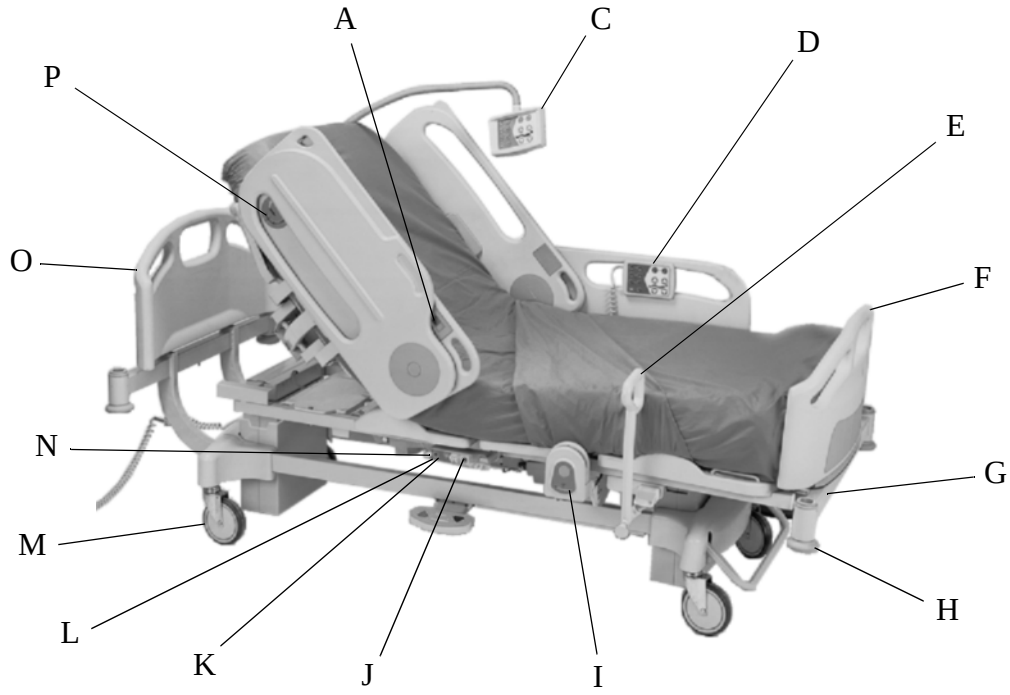
- Three adjustable sections: head, thigh and foot.
- Height adjustment of the sleep surface level.
- Inclination of the bed frame in trendelenburg (head down) or reverse trendelenburg (feet down)

The AvantGuard™ Electric Bed has a dual control system. Functions are acessable via AC power or a backup battery (optional):

- Hilow: sleep surface elevation - raise/lower
- Head section - raise/lower
- Thigh section - raise/lower
- Foot section - raise/lower (LI159Ax only)
- Trendelenburg/reverse trendelenburg
- Emergency trendelenburg

These controls are electrically operated (except for the FS on LI158Ax) and are accessible to the patient (except for trendelenburg/reverse trendelenburg and emergency trendelenburg) or the caregiver from the control pendant, control panel on a flexible arm, lateral caregiver unit (emergency trendelenburg only) or the hilow pedal (HL only).

Figure 1-4. AvantGuard™ Electric Bed



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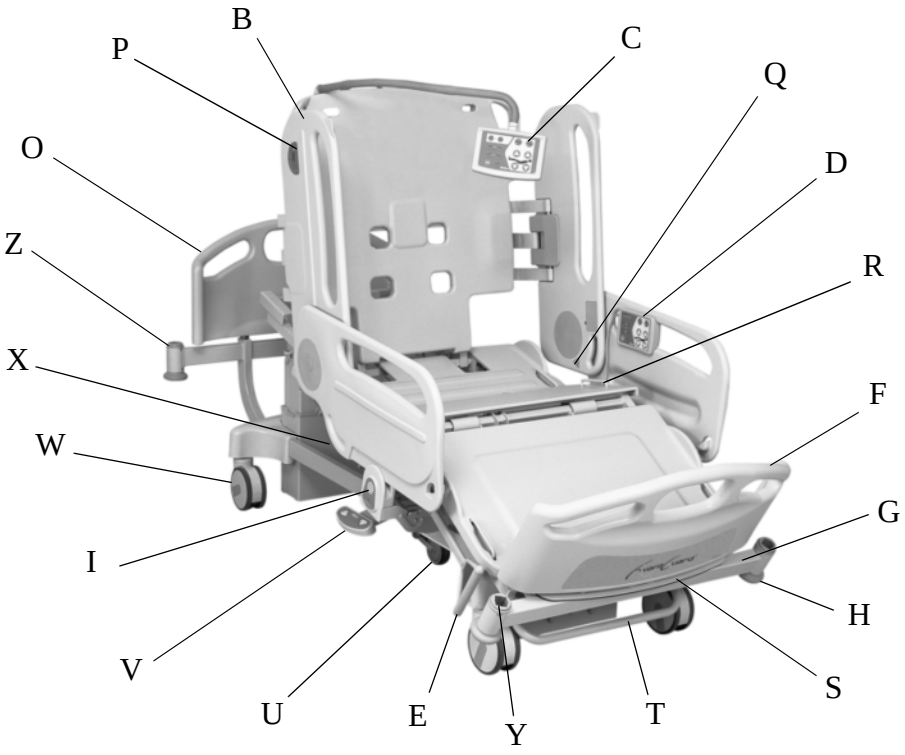

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Table 1-2. AvantGuard™ Electric Bed Feature Identification

Letter	Description
A	TotalGuard™ Integral Siderail release
B	TotalGuard™ Integral Siderail
C	Control panel on a flexible arm[a]
D	Control pendant
E	MobiBar™ Egress Bar[a]
F	Vertical removable footboard
G	Integral bed extension[a]
H	Bumper at each corner
I	Foot siderail support with trendelenburg/reverse trendelenburg angle and horizontal position indicator
J	Emergency trendelenburg
K	Electrical function management
L	Lateral caregiver unit (on each side)
M	Single band casters, diameter 150 mm[a]
N	CPR release
O	Removable headboard
P	Head section angle indicator
Q	Patient position indicator
R	6 attachment points for restraining straps
S	Linen holder[a]
T	Brake and steer control
U	5th wheel[a]
V	Hilow pedal[a]
W	Double band casters, diameter 150 mm
X	Accessory support bar[b]
Y	I.V. pole sockets at each corner
Z	I.V. pole and patient helper sockets at each head end corner

a. Optional
b. Not shown

Bed Positions

Figure 1-5. EasyChair™ Automatic Chair Position

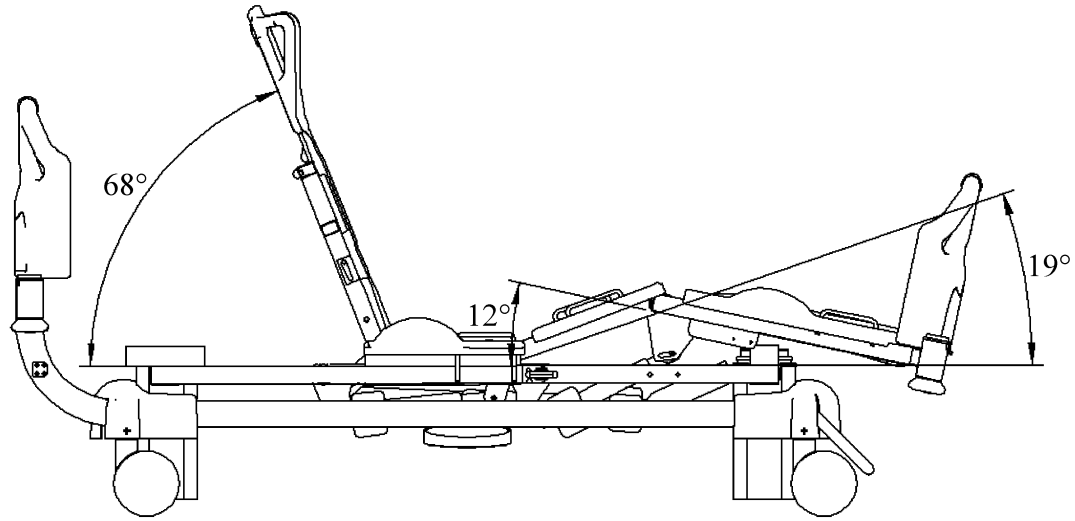

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Figure 1-6. Reverse Trendelenburg

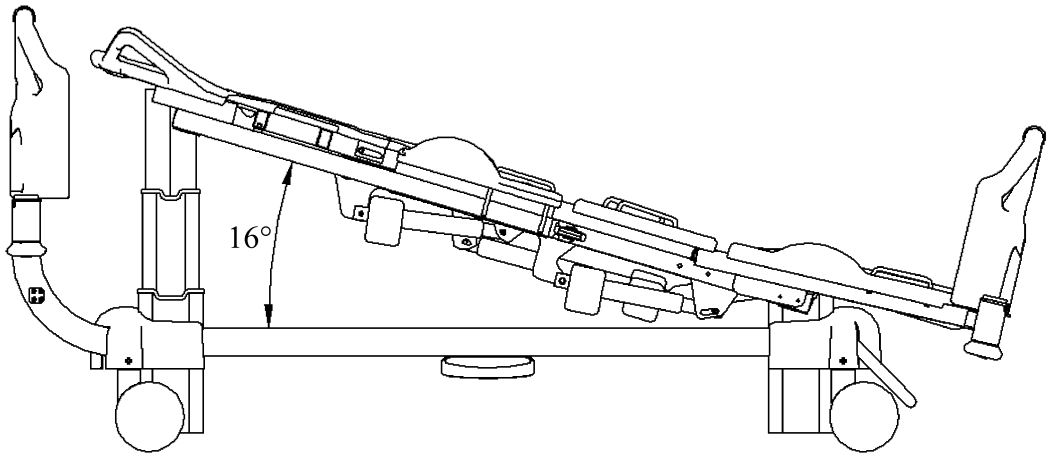

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Figure 1-7. Emergency Trendelenburg

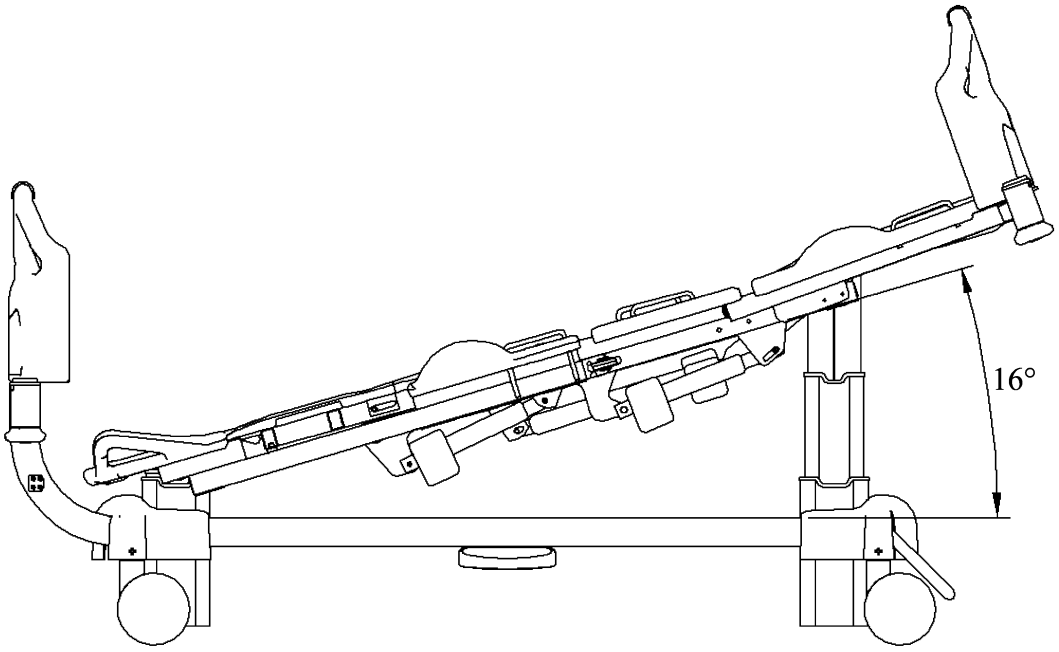

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Figure 1-8. EasyChair™ Automatic Chair Position and Reverse Trendelenburg

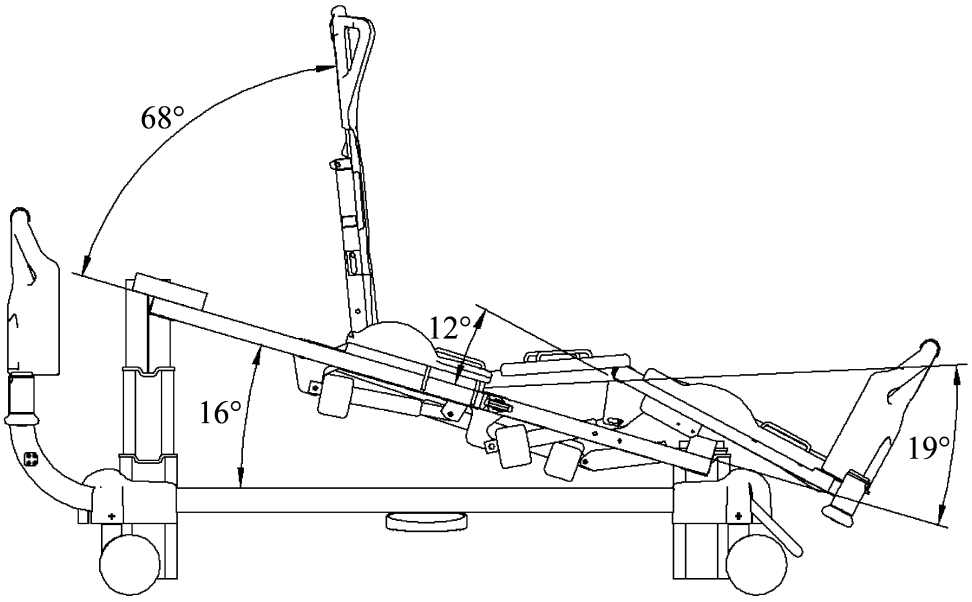

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Figure 1-9. Trendelenburg

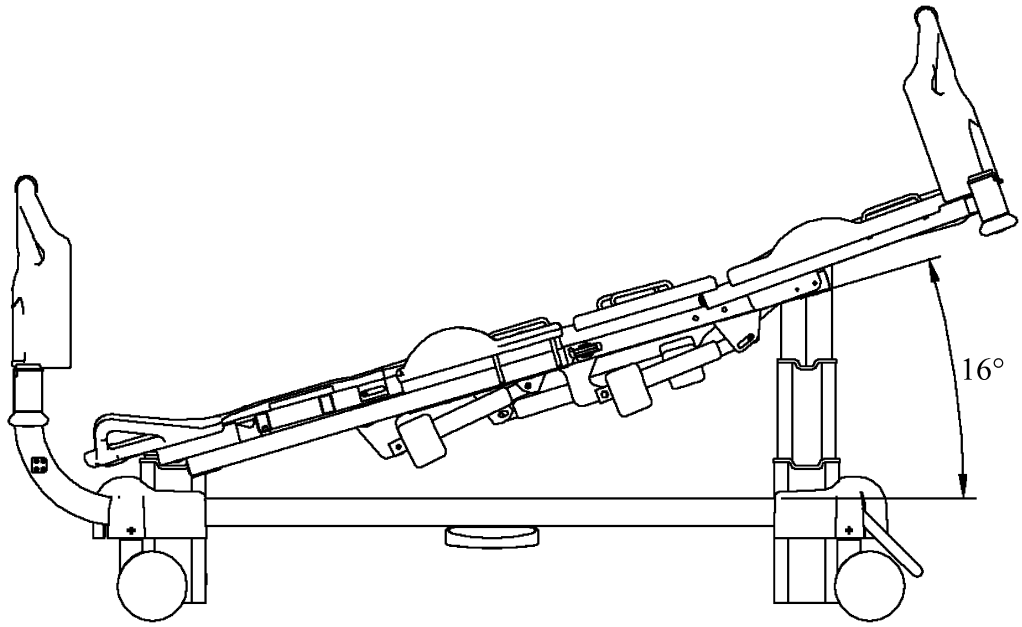

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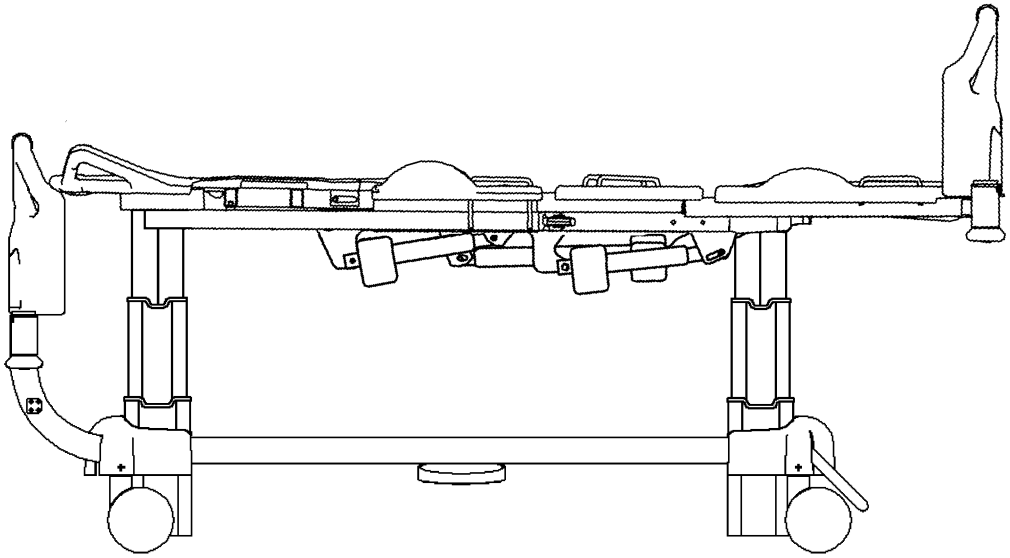
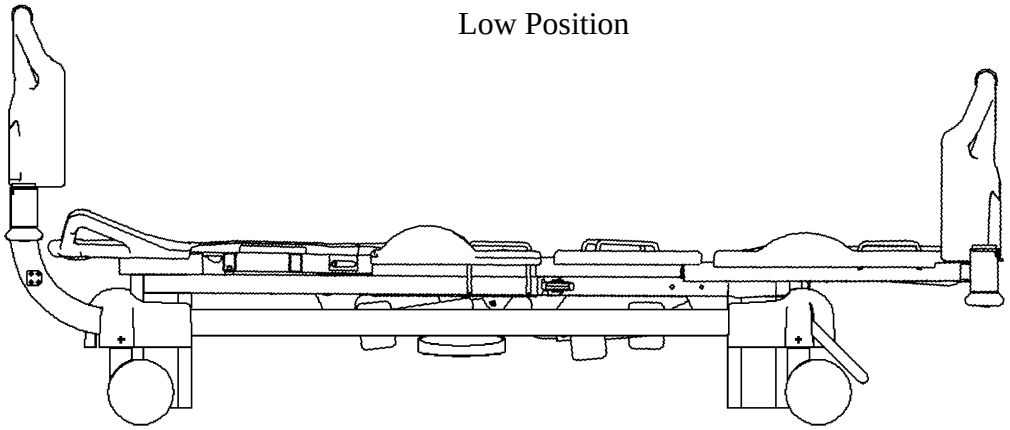
Figure 1-10. Hilow Positions

High Position



Low Position



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Operating Precautions

WARNING:
Driven bed mechanisms can cause serious injury. Do not operate bed controls until all persons are clear of mechanisms. A bed articulation function can be halted by releasing the control, pressing and holding the switch for the opposite function, or by unplugging the AC power connector.

Before you operate the bed, make sure to read and understand the contents of the *AvantGuard™ Electric Bed User Manual* and this manual. It is important that you read and strictly follow all safety guidelines in these manuals.

To help prevent falls by patients, always leave the bed in the low position; and set the brake when the patient is unattended.

Features

SHOCK HAZARD:
The use of electrical equipment carries a potential risk of electric shock. Personnel must be trained and instructed in the inherent risks of electrical equipment.

Figure 1-11. Control Pendant LI159Ax

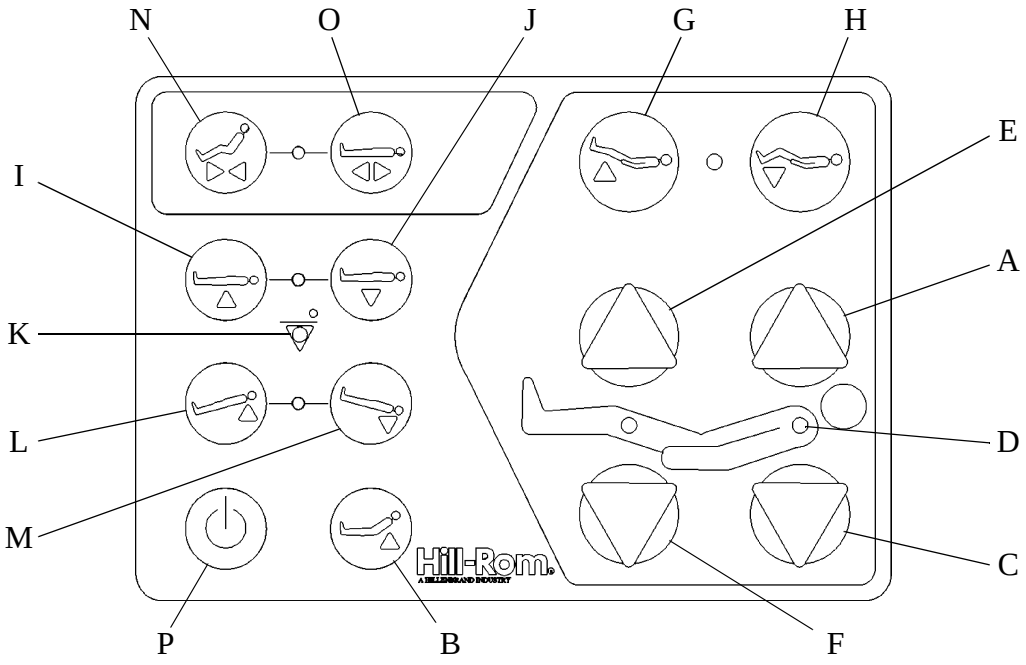

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Figure 1-12. Control Pendant LI158Ax

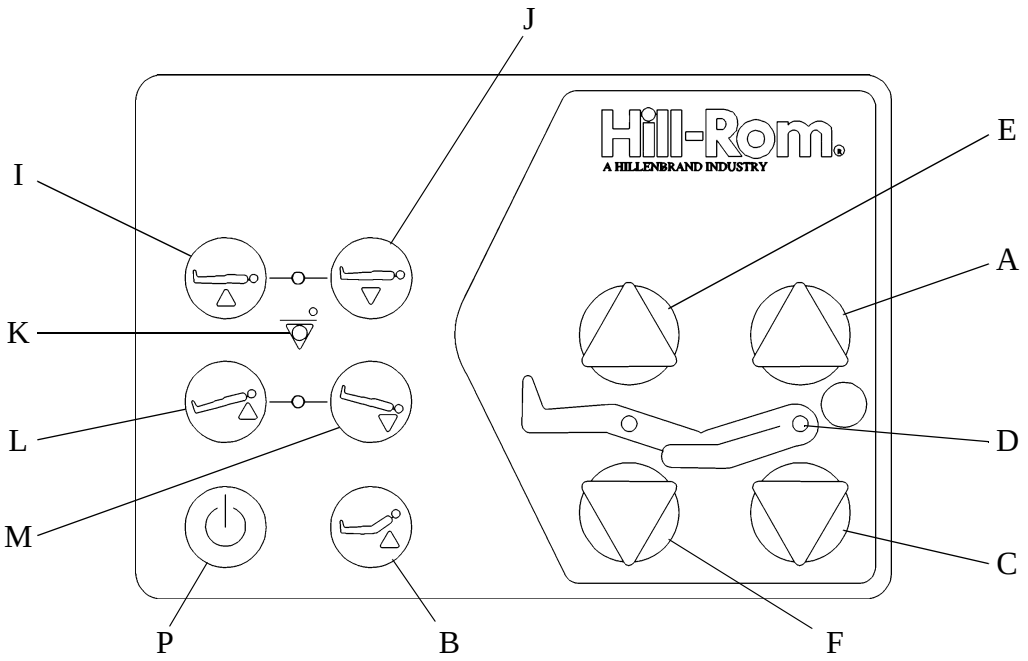


Table 1-3. Control Pendant Functions

Letter	Description
A	Head section raise with automatic contour
B	Head section raise without automatic contour
C	Head section lower with automatic contour
D	LED indicator for locking/unlocking of the function (available for each function)
E	Thigh section raise
F	Thigh section lower
G	Foot section raise
H	Foot section lower
I	Bed raise (sleep surface)
J	Bed lower (sleep surface)
K	Bed non-low position indicator
L	Reverse trendelenburg
M	Trendelenburg
N	EasyChair™ Automatic Chair position
O	Emergency release of the sleep surface sections
P	Activation of battery backup mode

Hilow Function

The sleep surface of the AvantGuard™ Electric Bed can be raised or lowered to move the patient or to facilitate getting on/off the bed. The column-based elevation system frees space under the sleep surface and enables trendelenburg/reverse trendelenburg to be obtained automatically by the control unit.

In order to raise the sleep surface, press and hold the hilow raise button on the control pendant, control panel on a flexible arm (I) or the hilow pedal. Release the button or pedal at the desired height or when the maximum height is reached (see figure 1-11 on page 1-14).

In order to lower the sleep surface, press and hold the hilow lower button on the control pendant, control panel on a flexible arm (J) or the hilow pedal. Release the button or pedal at the desired height or when the minimum height is reached.

Bed Non-Low Position Indicator

An LED lights up on the control unit when the bed is no longer in the low position in order to heighten caregivers' awareness of the risks inherent to the sleep surface height (refer to the user manual).

Head Section

The HS of the AvantGuard™ Electric Bed can be adjusted independently in order to obtain the desired inclination up to its maximum level. This function is activated from the control pendant or control panel on a flexible arm (optional or accessory). There are two specific buttons for the elevation: one for the HS only (B), the other for the operating with the automatic contour (A) (see figure 1-11 on page 1-14).

To raise the HS, press and hold one of the HS raise buttons on the control pendant or the control panel on a flexible arm (A). Release the button at the desired angle or when maximum elevation is reached.

To lower the HS, press and hold one of the HS lower buttons on the control pendant or the control panel on a flexible arm (C). Release the button at the desired angle or when the low position is reached.

Head Section Angle Indicators

A HS angle indicator, with ball bearing (O), is available on each head siderail. The labels are graduated for approximately every 10° of HS inclination, and from 0° to + 90° in one direction for normal use and from 0 to 20° in the other when the bed is in trendelenburg position (see figure 1-4 on page 1-8).

Retractable Head Section

Three movements occur simultaneously when the HS elevation is activated: elevation of the HS, retraction of the HS towards the head end of the bed and the sliding/extending movement of the HS hard surface on the HS frame. These

movements enlarge the sitting area, reduce pelvic pressure, enable the patient to breathe more easily by reducing abdominal pressure, limit the shearing forces and provide greater support for the head and neck.

CPR Emergency Release

The AvantGuard™ Electric Bed has an emergency lower function for the HS. The CPR release (M) is situated in the central part of the bed alongside the LCU (K) at either side under the sleep surface. Handles integral with the HS hard surface support the section during the emergency release phase.

Activating the HS emergency release function:

- Hold one side of the HS and pull one of the yellow CPR handles.
- Keep the handle pulled to control the lowering of the HS.

Deactivating the HS emergency release function:

- Release the CPR handle. The HS raise (A) function will then be available when the relevant control is used (see figure 1-11 on page 1-14).

Thigh Section

The TS of the AvantGuard™ Electric Bed can be adjusted independently to obtain the desired inclination up to its maximum value. This function (E) is activated from the control pendant or control panel on a flexible arm (optional or accessory).

To raise the TS, press and hold the TS raise button (E) on the control pendant or the control panel on a flexible arm. Release the button at the desired angle or when maximum elevation is reached.

To lower the TS, press and hold the TS lower button (F) on the control pendant or the control panel on a flexible arm. Release the button at the desired angle or when the low position is reached.

Foot Section

The FS of the AvantGuard™ Electric Bed can be electrically (LI159Ax) or mechanically (LI158Ax) adjusted independently to obtain the desired inclination up to its maximum value when the TS is at a minimum of mid-height. This function (G) is activated from the control pendant (optional or accessory) (LI159Ax) or from the control handle situated on either side of the sleep surface (LI158Ax).

To raise the FS of the LI159Ax model, press and hold the TS raise button (G) of the control pendant or control panel on a flexible arm until the TS reaches a minimum of mid-height. Next, press the FS raise button on the same control unit. Release the button at the desired angle or when maximum elevation is reached.

To lower the FS of the LI159Ax model, ensure that the TS is at least at mid-height and press the FS lower button (H) of the control pendant or control panel on a flexible arm. Release the button at the desired angle or when maximum lowering is reached.

Automatic Contour

Every AvantGuard™ Electric Bed has a special feature called automatic contour. This feature enables the TS of the bed to be raised automatically to a preset angle when the HS is raised from its horizontal position, provided that the TS is not locked out. The object of this feature is to prevent the patient slipping towards the foot of the bed when the HS is raised. It is activated from the control pendant (C) or control panel on a flexible arm (B) (optional or accessory) (see figure 1-4 on page 1-8).

Automatic contour raise: this feature is systematically active for the raise function when the specific HS raise button is activated on the control pendant or the control panel on a flexible arm.

Automatic contour lower: this feature is systematically active for the lowering function when the specific HS lower button is activated on the control pendant or control panel on a flexible arm. The TS lower is only carried out when the HS reaches low position.

A specific button (B) enables the elevation of the HS only if the automatic contour feature is not required. The automatic contour feature can also be disabled by locking out the TS from one of the lateral caregiver units. If this feature is to be used later on, the lockout must be deactivated (see figure 1-11 on page 1-14).

EasyChair™ Automatic Chair Position

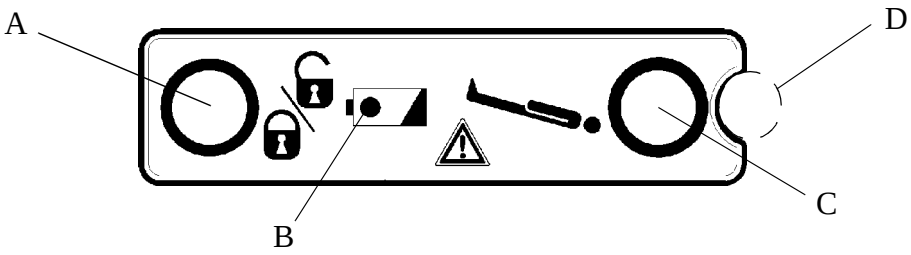
The combination of the electric controls of the sleep surface automatically adjusts the bed to the chair position. This function (N) is activated from the control pendant or control panel on a flexible arm (optional or accessory) on LI159Ax model only.

To adjust the bed to the EasyChair™ Automatic Chair position, press and hold the button (N) on the control pendant or control panel on a flexible arm. Release the button at the desired angle or when the maximum chair position is reached.

To exit the chair position, press the EasyChair™ Automatic Chair position exit button (O) on the control pendant or control panel on a flexible arm. Release the button at the desired angle or when the the sleep surface sections reach low position.

Lateral Caregiver Unit

Figure 1-13. Lateral Caregiver Unit with Emergency Trendelenburg Function



1680_102

Figure 1-14. Lateral Caregiver Unit without Emergency Trendelenburg Function

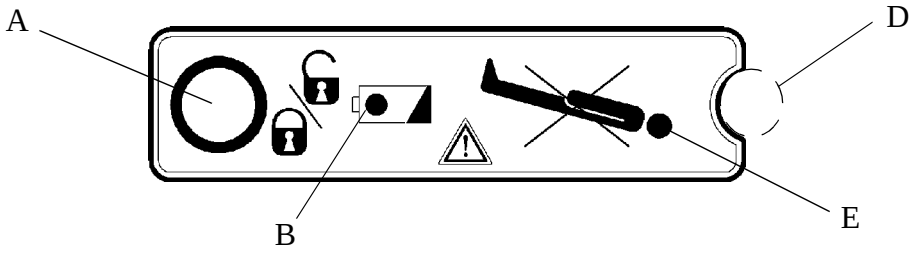


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Table 1-4. Lateral Caregiver Unit Identification

Letter	Description
A	Function management opening/trendelenburg reverse trendelenburg access opening
B	Low battery, battery charge LED indicator
C	Emergency trendelenburg function access opening
D	Lateral caregiver unit key storage
E	Emergency trendelenburg function not available on LI158Ax model

Figure 1-15. Lateral Caregiver Unit Key

1680_104

The lateral caregiver unit is situated on each side of the bed under the seat section of the sleep surface. The LCU key provides access (A) to the function lockout sequence, validation of the trendelenburg/reverse trendelenburg function and to the emergency trendelenburg function (C) (optional on LI158Ax). It also has a LED indicator (B) for low battery power, availability of battery power or battery charging (see figure 1-13 on page 1-19). The CPR control is separate from the LCU but is located next to it.

Electrical Function Management

The functions are locked out/unlocked according to the following sequence:

- Push momentarily the LCU key in the electrical function management/trendelenburg reverse trendelenburg access opening (A) of the LCU.
- The LEDs flash on the control unit (except for the trendelenburg/reverse trendelenburg LED which is continuously illuminated).
- Select the functions to be locked out (the LEDs go off) or unlocked (the LEDs start flashing again) by pressing the buttons of the relevant functions.
- Push momentarily the LCU key in the same opening to validate (or function management will automatically de-activate after approximately 1 min). Only the LEDs of the active functions remain lit.

NOTE:
If all the functions are initially locked out, no LED is lit at the moment of the first momentary push, except for the trendelenburg/reverse trendelenburg LED.

Trendelenburg/Reverse Trendelenburg

Trendelenburg/reverse trendelenburg is obtained according to the following sequence:

- Push momentarily the LCU key in the function management trendelenburg/reverse trendelenburg access opening (A) of the LCU.
- The trendelenburg/reverse trendelenburg function LED is on continuously on the control unit.
- Continuously press the button of the trendelenburg or reverse trendelenburg (according to requirements) of the control pendant or control panel on a flexible arm. Release the button when the sleep surface reaches the desired angle or maximum angle.
- Push momentarily the LCU key in the same opening to inhibit the function (or function management will automatically de-activate after approximately 1 min). The LED of the trendelenburg/reverse trendelenburg function goes off on the control unit.

The sleep surface can be inclined in 2 ways:

- in trendelenburg where the head of bed is lowered
- in reverse trendelenburg where the foot of bed is lowered

The maximum scope of trendelenburg movements is obtained irrespective of the the initial height of the sleep surface. This function is activated by the control pendant or control panel on a flexible arm after validation on the lateral caregiver unit and the control key.

Emergency Trendelenburg Function (Optional on LI158Ax)

The emergency trendelenburg function is obtained in the following manner:

- Fully insert the LCU key into the opening of the emergency trendelenburg function (C) and keep pressing it.
- The bed adjusts to the trendelenburg position and the sections of the bed frame are flat (as long as the key is pressed).
- Remove the LCU key and place it in its storage opening (D) to return to normal operation.

This emergency function simultaneously controls the lowering of the sleep surface and adjustment to the trendelenburg position. It is activated from the LCU and is available in the event of AC power failure via a battery.

TotalGuard™ Integral Siderails

The AvantGuard™ Electric Bed has siderails situated on either side of the bed at the HS and FS. The FS has a specific foldaway support located under the sleep surface. The foot siderail can also be removed if necessary.

When the foot siderail is folded away, each head siderail has two positions, high and low, and can be raised or lowered separately.

These siderails have special openings that enable the control pendant to be stored or moved and integrate a HS angle indicator.

- To raise the head siderail (including the folded foot siderail):
  - Pull the siderail out from the bed by rotating it until it reaches the high position. The position is secure when the siderail clicks into place.
- To lower the siderail (including the folded foot siderail):
  - Gently push the siderail inwards with one hand and activate the unlocking button (A) on the siderail, then rotate the siderail downward into the low position (see figure 1-4 on page 1-8).
- To deploy a foot siderail (only if the head siderail is in high position):
  - Grip the mobile section of the foot siderail and pivot it towards the FS of the bed, then position it in the support (H) provided for this purpose. The position is secure when the siderail clicks into place.

- To store a foot siderail:
  - With one hand, grip the upper mobile section of the siderail at the foot end of the bed, and with the other hand press the release button of the siderail support (H) then raise the siderail and pivot it towards the head end of the bed. Then position it in the support provided for this purpose on the head siderail.

Patient Positioning Locator

A locator triangle has been moulded on the inside of each head siderail (C) at the level of the foot siderail articulations to indicate the correct position of the patient's hips while on the bed.

Foot Siderail Supports

- To raise a foot siderail support (H):
  - Grip the support and move it upward until it locks. The position is secure when the foot siderail support clicks into place.
- To lower a foot siderail support:
  - Ensure that the corresponding foot siderail is folded away, grip the foot siderail support with one hand and with the other, operate the release button, then rotate the support downwards until it reaches the low position.

Trendelenburg/Reverse Angle Indicators

A sleep surface inclination indicator is available on each side of the bed on the foot siderail support (H). The label is graduated for every 5° steps of inclination, from 0° to + 15° in both inclination directions.

Brakes

The AvantGuard™ Electric Bed has a central braking system which is foot-controlled by means of a simple bar (S). Pressing it simultaneously brakes the four casters.

In order to apply the brakes on the bed, step on the brake and steer bar until it is tilted towards the floor.

To disengage the brakes, raise the brake and steer bar with your foot until it is parallel with the floor. The bar remains slightly tilted downwards when the bar is released.

Steering

The AvantGuard™ Electric Bed has a steering system which improves the handling of the bed while moving or transferring a patient. The right-hand caster at the head of the bed (patient viewpoint), or left-hand caster at the foot of the bed (optional) is fixed in a longitudinal position with respect to the bed when the bar is

raised. In this way the bed can be steered easily by pushing the foot or head end of the bed (depending on the configuration).

In order to engage the steering position, raise the brake and steer bar with your foot until it is tilting upwards.

To disengage the steering position, step on the brake and steer bar until it is parallel with the floor. The bar remains slightly tilted downwards when the bar is released.

Headboards and Footboards

The AvantGuard™ Electric Bed is equipped with shaped endboards at the head and foot of the bed. They can be removed vertically and aid the mobility and steering of the bed by the use of integrated handles. They have slots which allow them to be quickly inserted into plastic brackets placed on bars at the head and foot ends.

The head and foot boards are removed by pulling them upwards to lift them from the sockets at the head and foot end of the bed.

Hard Surfaces on the Head, Seat, Thigh and Foot Sections

To remove the hard surfaces from the FS and TS, hold each section individually on each side of the sleep surface at the restraining strap attachment points, then remove them by pulling upward.

To install the hard surfaces of the FS and TS, line them up on each side of the sleep surface, with respect to the restraining strap attachment points, then fit them in the relevant positions.

To remove and install the hard sections of the SS and HS, refer to procedure 4.1.

Casters

The AvantGuard™ Electric Bed is equipped with four swivelling casters situated at the four corners of the bed frame.

Restraining Strap Attachment Points

The AvantGuard™ Electric Bed has six attachment points for restraining straps. These points also support the hard surfaces of the SS, TS and FS.

Protective Bumpers

The protective bumpers are situated on the four corners of the bed, on the bed frame.

I.V. Pole Sockets

The AvantGuard™ Electric Bed has four IVP sockets, placed at each corner of the bed. An I.V. pole (accessory) can be inserted into each socket. The two sockets at the patient's head also enable a patient helper to be attached.

Optional Features

Hilow Pedal (Optional or Accessory)

The AvantGuard™ Electric Bed has, as an option or accessory, a bilateral hilow pedal which enables nursing staff to raise or lower the sleep surface.

Battery Backup (Optional)

The AvantGuard™ Electric Bed can be equipped with a battery backup that ensures the normal operation of the bed when it is moved or during AC power failure.

Detection of "Bed Connected to AC Power but Brakes not Applied" (Optional)

The brake must always be applied when the bed is connected to a power outlet. If the brake is not applied, a beep will sound as a reminder. This safety feature prevents the AC power cable from being pulled when the bed is moved. The beep will stop when the brake is applied, or when the power connector is unplugged from the power outlet.

MobiBar™ Egress Bar (Optional)

The AvantGuard™ Electric Bed can be equipped with egress bars that assist the patient in getting out of bed. They can be folded away so as not to hinder the caregiver or patient when not in use.

To use the MobiBar™ Egress Bar, pull outwards and rotate towards the head of the bed. To ensure the locking mechanism is secure, try to rotate it towards the foot of the bed.

To store the MobiBar™ Egress Bar, pull outwards and rotate towards the foot of the bed and under the sleep surface, then release.

5th Wheel Steering System (Optional on LI158Ax)

The 5th wheel system enables the AvantGuard™ Electric Bed to be moved more easily by providing a central steering point under the frame. It is activated or deactivated automatically according to the type of bed movement. If a 5th wheel steering system is fitted, there will not be a standard steer caster.

To set the 5th wheel in the bed moving position, position the bed in the direction of the movement required and move it in a straight line. The 5th wheel automatically sets to the required position.

To disengage the moving position and enable sideways movements, push the bed sideways and the 5th wheel will automatically unlock.

Extension (Optional)

The AvantGuard™ Electric Bed is designed for tall patients. The overall length of the bed can be increased significantly by sliding the crossbar of the foot panel along its guide rails. The mattress can be extended with the aid of a mattress extension cushion, available as an accessory, when the extension has been pulled out.

Two positions are available, stored and extended.

To use the extension, lift the handle located under the footboard, then pull out the extension. Ensure that the extension is secured in the notch on the guide rail.

To store the extension, lift the handle under the footboard, then push the extension. Ensure that the extension is secured by the notch on the guide rail.

Linen Holder (Optional)

The AvantGuard™ Electric Bed can be equipped with a linen holder that slides under the FS. When in use, it provides space for sheets and blankets when the bed is being made. The maximum load supported is 15 kg.

To use the linen holder, pull on the board located under the footboard, then tip the metal stop towards you.

To store the linen holder, tilt the metal stop away from you, then push the board under the footboard.

Accessory Support Bar (Optional or Accessory)

Two accessory support bars (Hill-Rom accessories, urine bag, drainage bag, etc.) are available under the central section of the sleep surface. The design enables the bags to be moved easily inwards or outwards by sliding them on their supports.

Medical Device Support Bar (Optional or Accessory)

Two medical device support bars are available under the central section of the sleep surface. Their position and movements are identical to the accessory suport bars.

Specifications

Physical Description

For the AvantGuard™ Electric Bed specifications, see table 1-5 on page 1-26.

Table 1-5. AvantGuard™ Electric Bed Specifications

Specification	Dimension
Overall length in high position (basic version)	2185 mm ± 5 mm (86")
Overall length in high position with extension (optional) in use	2365 mm ± 5 mm (93.1")
Overall width (siderails up)	1000 mm (39.4")
Overall width (siderails down)	940 mm (39.0")
Height of sleep surface (low position) depending on caster model	400 mm ±5 mm (15.8"): double band* 415 mm ±5 mm (16.3"): single band*
Height of sleep surface (high position) depending on caster model	800 mm 0/- 10 mm (31.5"): double band* 815 mm 0/- 10 mm (32.1"): single band*
Maximum space under bed (bed with hilow pedal)	150 mm (5.9"): double band casters: 163 mm (6.4"): single band casters
Maximum space under bed (bed without hilow pedal)	187 mm (7.4"): double band casters 200 mm (7.9"): single band casters
Maximum head section inclination	+68°
Thigh section inclination: automatic contour	20° ±2°
Maximum thigh section inclination	+36° ±2°
Maximum electric foot section from the horizontal	- 23° ±2°
If thigh section in mid-position	- 12.5° ±2°
Maximum assisted foot section from the horizontal	- 14° ±2 °
If thigh section in mid-position	- 5.5° ±2°

Specification	Dimension
Sleep surface inclination from the horizontal: trendelenburg/reverse trendelenburg	+16°/-16°
Maximum height of siderail above sleep surface	395 mm (15.6")
Maximum weight of bed (without mattress or accessories)	150 kg (331 Ib)
Safe working load	185 kg (408 Ib)
Maximum lifted load	250 kg (551 Ib)

* add 50 mm for a bed featuring the hilow 45 to 85 cm option.

Table 1-6. Transport and Storage Environmental Conditions

Condition	Range
Temperature	Between -10° and +50°C
Humidity	20% - 80% at 30°C
Pressure	500 hPa to 1060 hPa (0 to 2000m altitude)

Table 1-7. Environmental Conditions for Use

Condition	Range
Temperature	Between 0° and +40°C
Humidity	20% - 80% at 30°C
Pressure	700 hPa to 1060 hPa (0 to 2000m altitude)

Electrical Description

SHOCK HAZARD:
The use of electrical equipment carries a potential risk of electric shock. Personnel must be trained and instructed in the inherent risks of electrical equipment.

The electrical circuit is physically isolated from the metal parts of the bed.

Power Supply Unit

The AvantGuard™ Electric Bed is equipped with electric actuators for the HS, TS, and FS (except LI158Ax) and HL functions, which are controlled by via the power supply unit.

The power supply unit operates with 230VAC 50Hz (for tolerances, see table 3-2 on page 3-10), and can be equipped with a 24VDC battery backup (optional). This battery controls the functions of the bed when it is not supplied with AC power. A specific audible alarm can be heard when the battery power is low. It is set off when a function of the bed is activated, after having enabled the battery mode. When the alarms sounds, the bed plugged into an appropriate power source so that the battery can be recharged.

The AvantGuard™ Electric Bed complies with the IEC standard 60601-2-38 and ammendment 1 (for details, see “Regulations, Standards, and Codes” on page 1-29). Every bed undergoes operating tests before delivery and tests are carried out for earth conninuity, potential equalisation and leakage current.

Control Unit

Control Pendant

The control pendant provides access to bed electric functions and also provides indicators of function status. It operates at a very low safe voltage and comprises the buttons and LEDs that enable the bed to be controlled (except for low battery). It is connected to the rear of the LCU on the right or left of the sleep surface and is inserted easily into the siderails for storage. Two versions are available according to the bed model. Depending on whether or not the controls are locked out, they are accessible by the caregiver or patient (except for trendelenburg/reverse trendelenburg), and several functions can be enabled simultaneously.

Control Panel on a Flexible Arm (Optional or Accessory)

The AvantGuard™ Electric Bed can be equipped with a control panel on a flexible arm. This unit has the same functions as the control pendant and also comes in two versions. It is connected to the rear of the LCU on the right or left of the sleep surface simultaneously with the control pendant, but necessarily to the opposite LCU to the control pendant’s connection.

Motor-Driven Actuators

CAUTION:
The usage cycle (intermittent operation) of the actuators must not exceed 3min/30min, otherwise equipment damage could result.

The operation of the HS, TS and FS (LI159Ax only) is provided by three motor-driven actuators, and two columns for hilow. They are all designed in such a way as to be protected against the ingress of liquids under normal conditions of use.

The motor-driven actuators operate under a nominal 24VDC and have a connecting plug to facilitate removal/replacement should problems arise.

Each movement is only possible by keeping the button of the corresponding function pressed (no automatic movement). Depending on the function, a button corresponds to the movement of one or more actuators.

Regulations, Standards, and Codes

The AvantGuard™ Electric Bed complies with CE Directive 93/42/CEE applicable to class I medical equipment.

CE

NF MEDICAL

The AvantGuard™ Electric Bed complies with the following standards:

- NF-S-90-312
- NF-EN-60601-1
- NF-EN-60601-1-2 (1993)
- NF-EN-60601-2-38 Amendment 1

Model Identification

For AvantGuard™ Electric Bed model identification, see table 1-8 on page 1-30.

Table 1-8. Model Identification

Model Number	Description
LI158Ax	AvantGuard™ Electric Bed without EasyChair™ Automatic Chair function (mechanical FS)
LI159Ax	AvantGuard™ Electric Bed with EasyChair™ Automatic Chair function (electrical FS)

Safety Tips

CAUTION:
The usage cycle (intermittent operation) of the actuators must not exceed 3min/30min, otherwise equipment damage could result.

CAUTION:
The head section must always be horizontal when removing or fitting the head section hard surface. Failure to do so may give rise to an incorrect position and cause the elevation sliding system to malfunction.

CAUTION:
The polarities must be respected when installing the elements of the battery backup. Disregarding this caution will permanently damage the power supply P.C. board of the bed.

CAUTION:
Ensure that the elastic found on the new actuators is not wound around the actuator body before removing it (cut). If necessary, turn the actuator end rod in the appropriate direction to unwind this elastic. Indeed, it is used to indicate the correct position of the switches and internal end of travels of the actuator. The incorrect position of these elements may damage the actuator or the structure of the bed.

CAUTION:
If the sleep surface cannot be raised to mid-height for whatever reason, the arms of the elevation tool must not be positioned at the level of the actuators. Disregarding this caution may cause the head section and foot section actuators to malfunction.

CAUTION:
Ensure the caster is correctly positioned with respect to the movements of the hexagonal bar. Disregarding this caution may cause the brake and steer system to malfunction.

CAUTION:
When turning the double band caster, it is very important not to turn the caster until it is no longer braked, otherwise it may become impossible to adjust and damage may occur.

CAUTION:
Always set the foot siderail to the folded position. Failure to do so could result in equipment damage.

CAUGHT HAZARD:
The elevation tool must be used to remove the column in safety. Use the elevation tool, otherwise personal injury could occur.

CAUGHT HAZARD:
The bed frame must be secured, lengthways, to prevent it coming away from the rail at the level of the head HL column. Disregarding this hazard may cause injuries.

SHOCK HAZARD:
The use of electrical equipment carries a potential risk of electric shock. Personnel must be trained and instructed in the inherent risks of electrical equipment.

SHOCK HAZARD:
An abnormally high leakage current is symptomatic of a degradation within the AC power cable and the PSU. Personal injury could result if the value of the leakage current is above 500 microamperes.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

SHOCK HAZARD:
The equipotential link and the grounding of the metal parts of the bed depend on the correct installation of the earth conductor and grounding spring blades. Personal injury could result if the installation is not correct and/or if the earth continuity is compromised.

SHOCK HAZARD:
Ensure that the elastic found on the new actuators is not wound around the actuator body before removing it (cut). If necessary, turn the actuator end rod in the appropriate direction to unwind this elastic. It is used to indicate the correct position of the switches and internal end of travels of the actuator. The incorrect position of these elements may damage the actuator or the structure of the bed.

SHOCK HAZARD:
Unplug the bed before any cleaning or maintenance. Failure to do so could result in personal injury or equipment damage. Refer to the *AvantGuard™ Electric Bed User Manual* and to the specific chapters of this manual for any additional cautions and warnings.

SHOCK HAZARD:
Electric current flows through the connections when the bed is switched on. Trials conducted under these conditions carry a risk of electric shock. Do not touch any wire or terminal which conducts an electric current. Failure to observe this warning could result in personal injury or equipment damage.

WARNING:
Driven bed mechanisms can cause serious injury. Do not operate bed controls until all persons are clear of mechanisms. A bed articulation function can be halted by releasing the control, pressing and holding the switch for the opposite function, or by unplugging the AC power connector.

WARNING:
This manual describes the overall functions of the AvantGuard™ Electric Bed and their use, but it is in no way intended to replace the user manual, the purpose of which is to describe these functions in detail. For precise information relating to the use of the AvantGuard™ Electric Bed, refer to the user manual.

WARNING:
Consult the user manual before using the AvantGuard™ Electric Bed. Failure to do so could result in personal injury or equipment damage.

WARNING:
Only facility-authorised personnel should troubleshoot the AvantGuard™ Electric Bed. Troubleshooting by unauthorised personnel could result in personal injury or equipment damage.

WARNING:
The column must be replaced if it becomes defective. The column must never be dismantled. Failure to observe this warning could result in personal injury.

WARNING:
Two persons are required to test the articulation of the head section. Disregarding this precaution may result in personal injury or equipment damage.

WARNING:
Only the AC power cables listed in chapter 5 can be used on the AvantGuard™ Electric Bed. Other cables may compromise the safety and conformity of the bed.

WARNING:
Never lift the entire bed with the elevation tool. Its maximum load is 150kg. Disregarding this warning may cause the elevation mechanism to malfunction and could cause injury.

WARNING:
Do not remove the identification label from the bed, the references featuring on it are essential for identifying the bed and guaranteeing the safety of the maintenance operations. Failure to observe this warning could result in personal injury or equipment damage.

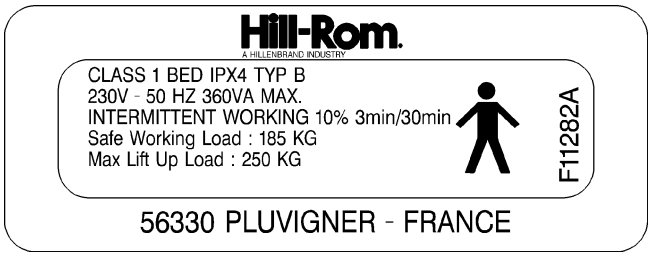
WARNING:
Only the facility-authorised maintenance personnel should perform preventive maintenance on the on the AvantGuard™ Electric Bed. Preventive maintenance performed by unauthorised personnel could result in personal injury or equipment damage.

WARNING:
Only the accessories specifically identified below are authorised to be used on the AvantGuard™ Electric Bed. Any use of accessories not included in the list may compromise the safety of the AvantGuard™ Electric Bed.

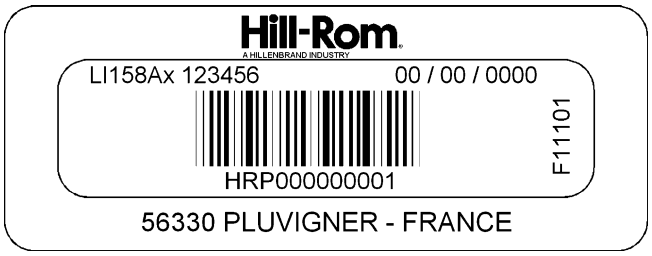
WARNING:
Consult the AvantGuard™ Electric Bed User Manual before using the accessories to prevent any risk of injury to the patient or user.

Identification and Caution Labels

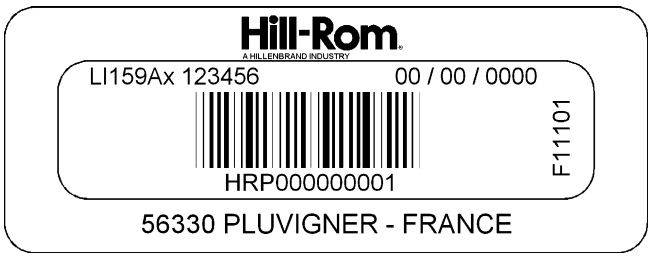
Figure 1-16. Identification and Caution Labels


Hill-Rom
A HILLENBRAND INDUSTRY
CLASS 1 BED IPX4 TYP B
230V - 50 HZ 360VA MAX.
INTERMITTENT WORKING 10% 3min/30min
Safe Working Load : 185 KG
Max Lift Up Load : 250 KG
F11282A
56330 PLUVIGNER - FRANCE

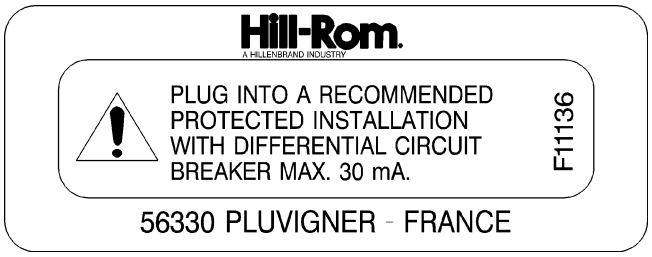
1787_106



1680_107



1680_108



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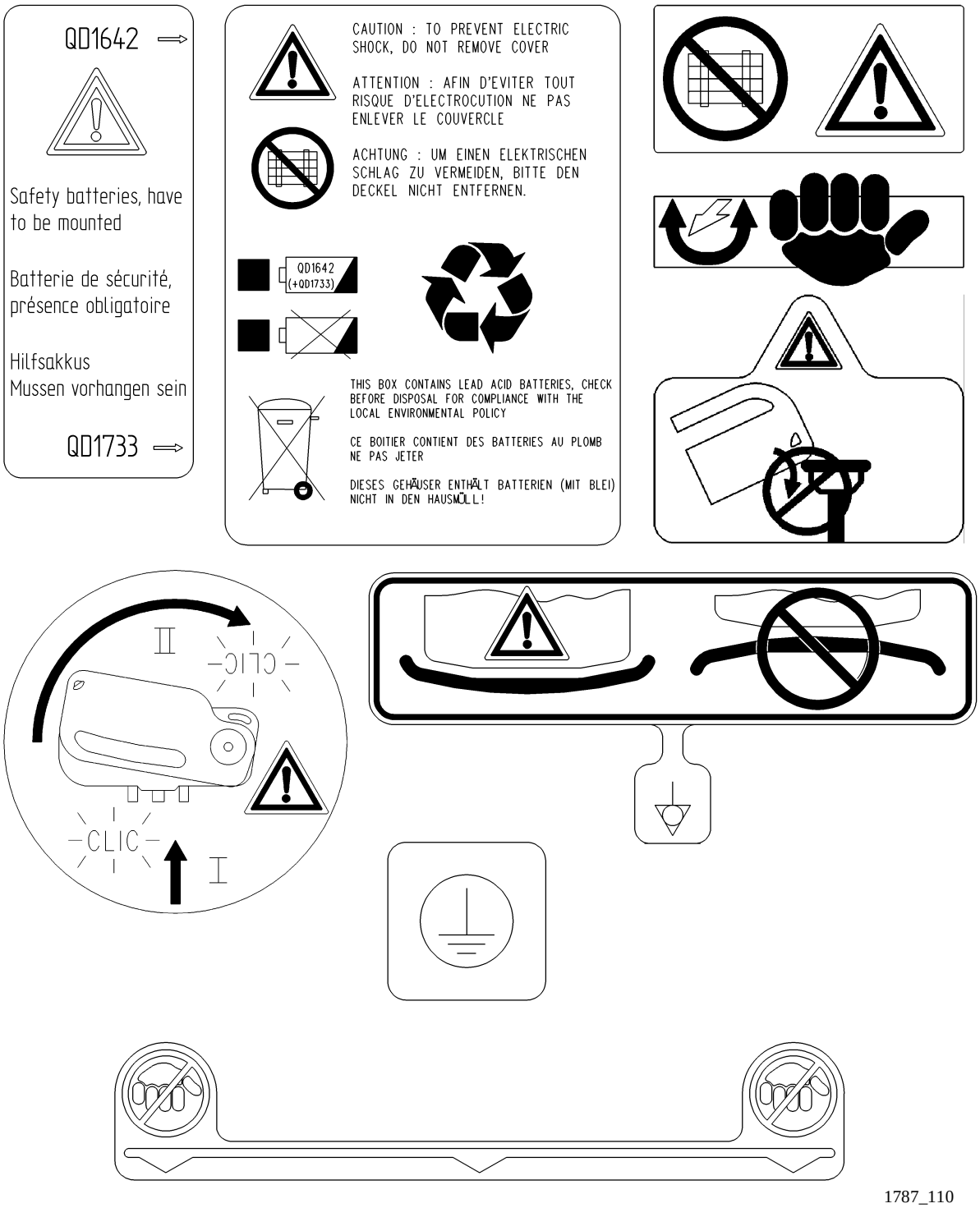
1680_118


QD1642
Safety batteries, have to be mounted
Batterie de sécurité, présence obligatoire
Hilfsakkus Mussen vorhangen sein
QD1733
CAUTION : TO PREVENT ELECTRIC SHOCK, DO NOT REMOVE COVER
ATTENTION : AFIN D'EVITER TOUT RISQUE D'ELECTROCUTION NE PAS ENLEVER LE COUVERCLE
ACHTUNG : UM EINEN ELEKTRISCHEN SCHLAG ZU VERMEIDEN, BITTE DEN DECKEL NICHT ENTFERNEN.
QD1642 (+QD1733)
THIS BOX CONTAINS LEAD ACID BATTERIES, CHECK BEFORE DISPOSAL FOR COMPLIANCE WITH THE LOCAL ENVIRONMENTAL POLICY
CE BOITIER CONTIENT DES BATTERIES AU PLOMB NE PAS JETER
DIESES GEHÄUSER ENTHÄLT BATTERIEN (MIT BLEI) NICHT IN DEN HAUSMÜLL!
CLIC
II
CLIC
I

1787_110

Chapter 2
Troubleshooting Procedures

2

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Getting Started

Begin each procedure in this chapter with step 1. Follow the sequence outlined (each step assumes that the previous steps are correct). Each step is the normal operational event of the product and can be confirmed by answering Y (yes) or N (no) to the question. Your response leads either to another step in the procedure, a Repair and Analysis Procedure (RAP), or the replacement of a component. If a number of components are mentioned, replace them in the order given.

Start with initial actions to collect the initial information concerning the problem.

Perform the function checks to isolate/identify a problem and verify the repair after completing each corrective action (replacing or adjusting a part, installation of a cable, etc.).

Perform the final actions after the function checks in order to verify the repair.

If troubleshooting procedures do not isolate the problem, ask for technical support from your national Hill-Rom representative: refer to the last page of this manual.

WARNING:
Only facility-authorised personnel should troubleshoot the AvantGuard™ Electric Bed. Troubleshooting by unauthorised personnel could result in personal injury or equipment damage.

NOTE:
The purpose of this troubleshooting method is to limit as much as possible the number of spare parts necessary and the cost incurred by a breakdown analysis.

NOTE:
It is recommended that you lock out the power-driven functions not concerned by the repair analysis before beginning, or unplug the bed if the repair is not connected to a power-driven function. In this case also, lock out all functions if the bed has a battery.

NOTE:
Refer to table 1-1 on page 1-6 for all acronyms used in the following chapters.

Initial Actions

Use Initial Actions to gather information from operators concerning problems with the AvantGuard™ Electric Bed. Note the symptoms or other information concerning the problem that the operator describes. This information helps identify the probable cause.

1. Someone who can explain the problem is available.

   Yes **No**
   ↓ → Go to "Function Checks" on page 2-6.

2. Ask this person to demonstrate or explain the problem. The problem can be duplicated.

   Yes **No**
   ↓ → Go to "Function Checks" on page 2-6.

3. The problem is a result of improper operator action.

   Yes **No**
   ↓ → Refer to table 2-1 on page 2-4, or go to "Function Checks" on page 2-6

4. Instruct the operator to refer to the procedures in the AvantGuard™ Electric Bed. Perform the "Function Checks" to ensure proper operation of the AvantGuard™ Electric Bed.

Rapid Problem/Solution Identification Table

If a problem with the bed is identified rapidly, use the following table to identify the appropriate troubleshooting procedure.

Table 2-1. Rapid Problem/Solution Identification Table

Problem	Solution
No Functions Work	RAP 2.1
Control Unit Malfunction	RAP 2.2
Function Management Mode Malfunction	RAP 2.3
Hilow Malfunction	RAP 2.4
Thigh Section Malfunction	RAP 2.5
Head Section Malfunction (excluding Automatic Contour)	RAP 2.6
Automatic Contour Malfunction	RAP 2.7
Battery Backup Malfunction	RAP 2.8
Foot Section Malfunction	RAP 2.9
Assisted Foot Section Malfunction	RAP 2.10
EasyChair™ Automatic Chair Position Malfunction	RAP 2.11

Problem	Solution
Trendelenburg/Reverse Trendelenburg Malfunction	RAP 2.12
Emergency Trendelenburg Function not Working with Bed Connected to AC Power	RAP 2.13
Emergency Trendelenburg Function not Working with the Bed not Connected to AC Power	RAP 2.14
Bed Connected to AC Power, Brakes not Applied Detection Malfunction	RAP 2.15
CPR Malfunction	RAP 2.16
Foot Siderail Locking/Unlocking Malfunction	RAP 2.17
Head Siderail Locking/Unlocking Malfunction	RAP 2.18
Braking Malfunction	RAP 2.19
Steering Malfunction	RAP 2.20
5th Wheel Steering Malfunction	RAP 2.21

Function Checks

1. The "Initial Actions" have been performed.

   Yes **No**
   ↓ → Go to “Initial Actions” on page 2-4.

2. Apply the brakes on the bed and raise and lock the siderails in the high position with the foot siderails folded. Carry out the following instructions:

   a. Unplug the power connector from the power outlet.

   b. Discover the causes of the problem, for instance, cables or connectors ripped out or damaged.

   c. Plug in the power connector to an appropriate power source.

   d. Switch on the power outlet switch if one is fitted.

   No LED is lit on the control unit.

   Yes **No**
   ↓ → Go to step 5.

3. Operate the emergency trendelenburg function if the bed is equipped with it.

   This function works.

   Yes **No**
   ↓ → Go to RAP 2.1 on page 2-13.

4. Unlock at least one bed function (such as the HS).

   The LED corresponding to the function is lit green.

   Yes **No**
   ↓ → Go to RAP 2.2 on page 2-16.

5. Lock out all the functions by applying the normal function management sequence.

   All the control unit LEDs (except reverse trendelenburg LED and non-low position HL LED) flash during the sequence and go off at the end of the sequence.

   Yes **No**
   ↓ → Go to RAP 2.3 on page 2-18.

6. Unlock all the functions by applying the normal function unlocking sequence.

   All the control unit LEDs (except reverse trendelenburg LED and non-low position HL LED) flash during the sequence and remain lit constantly at the end of the sequence.

   Yes **No**
   ↓ → Go to RAP 2.3 on page 2-18.

7. Press the raise control of the HL function, then the left and right raise pedal controls.

The bed rises to the high position without stopping or the audible alarm sounding during the movement.

Yes **No**
↓ → Go to RAP 2.4 on page 2-20.

8. Press the lower control of the HL function, then the left and right lower pedal controls.

   The bed goes down to the low position without stopping or the audible alarm sounding during the movement. In addition, the "bed in low position" LED goes off when the bed reaches the maximum low position.

   Yes **No**
   ↓ → Go to RAP 2.4 on page 2-20.

9. Press the raise button of the TS function.

   The TS rises to the high position without stopping or the audible alarm sounding during the movement.

   Yes **No**
   ↓ → Go to RAP 2.5 on page 2-22.

10. Press the lower button of the TS function.

    The TS goes down to the low position without stopping or the audible alarm sounding during the movement.

    Yes **No**
    ↓ → Go to RAP 2.5 on page 2-22.

11. Press the raise button of the HS function only (note that there are two raise buttons for this function).

    The HS rises to the high position without stopping or the audible alarm sounding during the movement. In addition, the hard surface moves upward on the section (RHS).

    Yes **No**
    ↓ → Go to RAP 2.6 on page 2-24.

12. Press the lower button of the HS function.

    The HS goes down to the low position without stopping or the audible alarm sounding during the movement (do not consider the TS actuator). In addition, the hard surface moves downward on the RHS section.

    Yes **No**
    ↓ → Go to RAP 2.6 on page 2-24.

13. Press the raise button of the HS with automatic contour function button from the horizontal position of the base frame (note that there are two raise buttons for this HS function).

    The HS and TS rise simultaneously, then the TS stops at an angle approaching 17° while the HS continues to rise to its highest position.

Yes **No**
↓ → Go to RAP 2.7 on page 2-26.

14. Press the lower button of the HS function from its highest position.

    The HS goes down, then the TS continues to drop when the HS reaches low position.

    Yes **No**
    ↓ → Go to RAP 2.7 on page 2-26.

15. If the bed is fitted with battery backup (optional), unplug the power connector from the power outlet, and test the functions checked in step 12 to step 14.

    The bed works properly.

    Yes **No**
    ↓ → Go to RAP 2.8 on page 2-29.

16. If the bed is fitted with a power-driven FS: operate the TS raise control until it reaches the high position. Next, press the FS function raise button.

    The FS rises to the high position without stopping or the audible alarm sounding during the movement.

    Yes **No**
    ↓ → Go to RAP 2.9 on page 2-31.

17. If the bed is fitted with a power-driven FS: press the lower button of the FS function.

    The FS drops to the low position without stopping or the audible alarm sounding during the movement.

    Yes **No**
    ↓ → Go to RAP 2.9 on page 2-31.

18. If the bed is fitted with an assisted FS: operate the control lever of the gas spring and raise the section to high position. Release the lever.

    The FS rises without hindrance and remains in the high position.

    Yes **No**
    ↓ → Go to RAP 2.10 on page 2-34.

19. If the bed is fitted with an assisted FS: operate the control lever of the gas spring and lower the section to low position. Release the lever.

    The FS drops without hindrance and remains locked when the lever is released.

    Yes **No**
    ↓ → Go to RAP 2.10 on page 2-34.

20. Adjust the TS to horizontal. If the bed is fitted with a chair function: press the chair position function of the bed.

    The HS and TS sections rise as long as the button is pressed until the required position is reached and the HS lowers when the TS reaches an angle approaching 17°.

Yes **No**
↓ → Go to RAP 2.11 on page 2-35.

21. If the bed is fitted with a chair function: press the non-chair position button of the bed.

    The HS, TS and FS sections gradually return to the horizontal as long as the button is pressed.

    Yes **No**
    ↓ → Go to RAP 2.11 on page 2-35.

22. Operate the HL raise until the intermediate position is reached, then operate the sleep surface trendelenburg by using the lateral caregiver unit.

    The sleep surface gradually tilts to maximum trendelenburg without any problem or abnormal noise.

    Yes **No**
    ↓ → Go to RAP 2.12 on page 2-36.

23. Operate the sleep surface reverse trendelenburg by using the lateral caregiver unit.

    The sleep surface gradually tilts to maximum reverse trendelenburg without any problem or abnormal noise.

    Yes **No**
    ↓ → Go to RAP 2.12 on page 2-36.

24. If the bed is fitted with an emergency trendelenburg function (optional): Leave the bed in reverse trendelenburg position and operate the HS raise to high position. Next, enable the emergency trendelenburg function by using the two lateral caregiver units successively and carry out the movement in several stages.

    The bed moves gradually to trendelenburg while the sections of the bed frame move to the horizontal position.

    Yes **No**
    ↓ → Go to RAP 2.13 on page 2-37.

25. Adjust the bed to reverse trendelenburg with the HS section in high position then unplug the power connector from the power outlet. Operate the emergency trendelenburg function again from one of the lateral caregiver units and carry out the movement in one stage.

    The bed moves gradually to trendelenburg while the sections of the bed frame move to the horizontal position.

    Yes **No**
    ↓ → Go to RAP 2.14 on page 2-39.

26. Plug the bed into an appropriate power source. If the bed is fitted with a detection of bed connected to AC power but brakes not applied (optional for LI158Ax): set the brake bar to neutral.

An audible alarm can be heard.

Yes **No**
↓ → Go to RAP 2.15 on page 2-42.

27. Set the bar to brake position.

    The audible alarm stops sounding.

    Yes **No**
    ↓ → Go to RAP 2.15 on page 2-42.

28. Press the HS raise button until the section reaches high position.

NOTE:
Someone should be lying on the bed so that this test can be carried out conclusively.

Pull each of the CPR (head section emergency release) handles in turn.

The HS descends quickly up to the mid-travel then the movement is cushioned until the low position is reached. The movement occurs without any problem or abnormal noise.

Yes **No**
↓ → Go to RAP 2.16 on page 2-44.

29. Release the CPR handles and operate the HS raise on the control unit to check that the HS actuator drive mechanism is working correctly.

    The HS rises without any problem or abnormal noise.

    Yes **No**
    ↓ → Go to RAP 2.16 on page 2-44.

30. Unfold the siderails. Check that they lock correctly into the supports provided and unlock when the unlocking control is activated.

    The locking/unlocking operates correctly.

    Yes **No**
    ↓ → Go to RAP 2.17 on page 2-45.

31. Fold the foot siderails after having unlocked them. Check that the head siderails lock correctly, then operate the release controls to lower them.

    The locking is correct and the siderails lower without any problem or abnormal noise.

    Yes **No**
    ↓ → Go to RAP 2.18 on page 2-46.

32. Try to move the bed with the brake still applied.

    The four wheels are locked and prevent any movement.

    Yes **No**
    ↓ → Go to RAP 2.19 on page 2-47.

33. For beds not equipped with 5th wheel system, set the brake/steer bar to "steer" position and trigger the lengthways locking of the steer caster.

    The caster locks in the expected position.

    Yes **No**
    ↓ → Go to RAP 2.20 on page 2-48.

34. For beds equipped with 5th wheel system, push the bed in the lengthways direction to lock the 5th wheel in the direction of the bed movement and move the bed by veering to the left then to the right.

    The caster unlocks in the expected position and remains locked when the bed turns to the right or left.

    Yes **No**
    ↓ → Go to RAP 2.21 on page 2-49.

35. For beds equipped with 5th wheel system, push the bed sideways to move it diagonally.

    The caster unlocks to allow sideways movement.

    Yes **No**
    ↓ → Go to RAP 2.21 on page 2-49.

36. Go to “Final Actions” on page 2-12.

Final Actions

1. Perform the required preventative maintenance procedures. See “Preventive Maintenance Checklist” on page 6-16.

2. Carry out all necessary administrative tasks.

Appendix

- A test control unit (P/N AG0061) is recommended for most of the following investigation procedures.
    - This unit contains all the functions of the control pendant (CU: all options) and Lateral Caregiver Unit (LCU) of the bed and can be connected inside the power supply unit (PSU: connector 1a or 1b (grey) mark (D) (see figure 4-10 on page 4-19)).
    - However, for all of these tests, a control pendant CU QD1604 can be used. The control pendant can be connected at the rear of the LCU (see figure 4-6 on page 4-11).
- A HL column simulation connector (P/N AG0062) allows the working of the PSU column output to be checked. (2 Red and Green LEDs enable you to determine whether the actuator is being controlled for raise or lower.)
- An actuator simulation connector (P/N AG0063) allows the working of the outputs (on the PSU) to be checked for the TS or FS.
- Another actuator simulation connector (P/N AG0064) allows the working of the HS actuator output (on the PSU) to be checked.

2.1 No Functions Work

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
This RAP assumes that no functions work from the HL pedal, the control pendant or control panel on a flexible arm.

NOTE:
To access the PSU (see figure 4-9 on page 4-19), and connections (see figure 4-10 on page 4-19).

SHOCK HAZARD:
The use of electrical equipment carries a potential risk of electric shock. Personnel must be trained and instructed in the inherent risks of electrical equipment.

1. Verify that the AC power cable works properly.

   The power connector is correctly plugged into the power outlet.

   Yes **No**
   ↓ → Connect the plug, check that it is correctly plugged in. Then go to "Function Checks" on page 2-6.

2. Unplug the power connector from the power outlet and use an appropriate test device to check for the presence of the voltage at the power outlet.

   The voltage is correct.

   Yes **No**
   ↓ → Inform the customer of the problem concerning the power outlet. Connect the bed to a working power outlet then go to "Function Checks" on page 2-6.

3. Inspect the AC power cable for any damage to the cable up to the PSU input (no crushing apparent or cut visible).

   The AC power cable is in satisfactory condition.

   Yes **No**
   ↓ → Replace the AC power cable (refer to procedure 4.4 on page 4-15).

4. Adjust the HS to the high position using the CPR control (2 people required).

SHOCK HAZARD:
Electric current flows through the connections when the bed is switched on. Trials conducted under these conditions carry a risk of electric shock. Do not touch any wire or terminal which conducts an electric current.

a. Remove the PSU cover using the 13 mm combination spanner (see figure 4-9 on page 4-19).

b. Plug the unit into a power outlet.

c. On the AC power input connector (E) (see figure 4-10 on page 4-19), check for the presence of the AC voltage using a DMM set to AC volts (see figure 2-1 on page 2-15).

The voltage is correct.

Yes **No**
↓ → Replace the AC power cable (refer to procedure 4.4 on page 4-15).

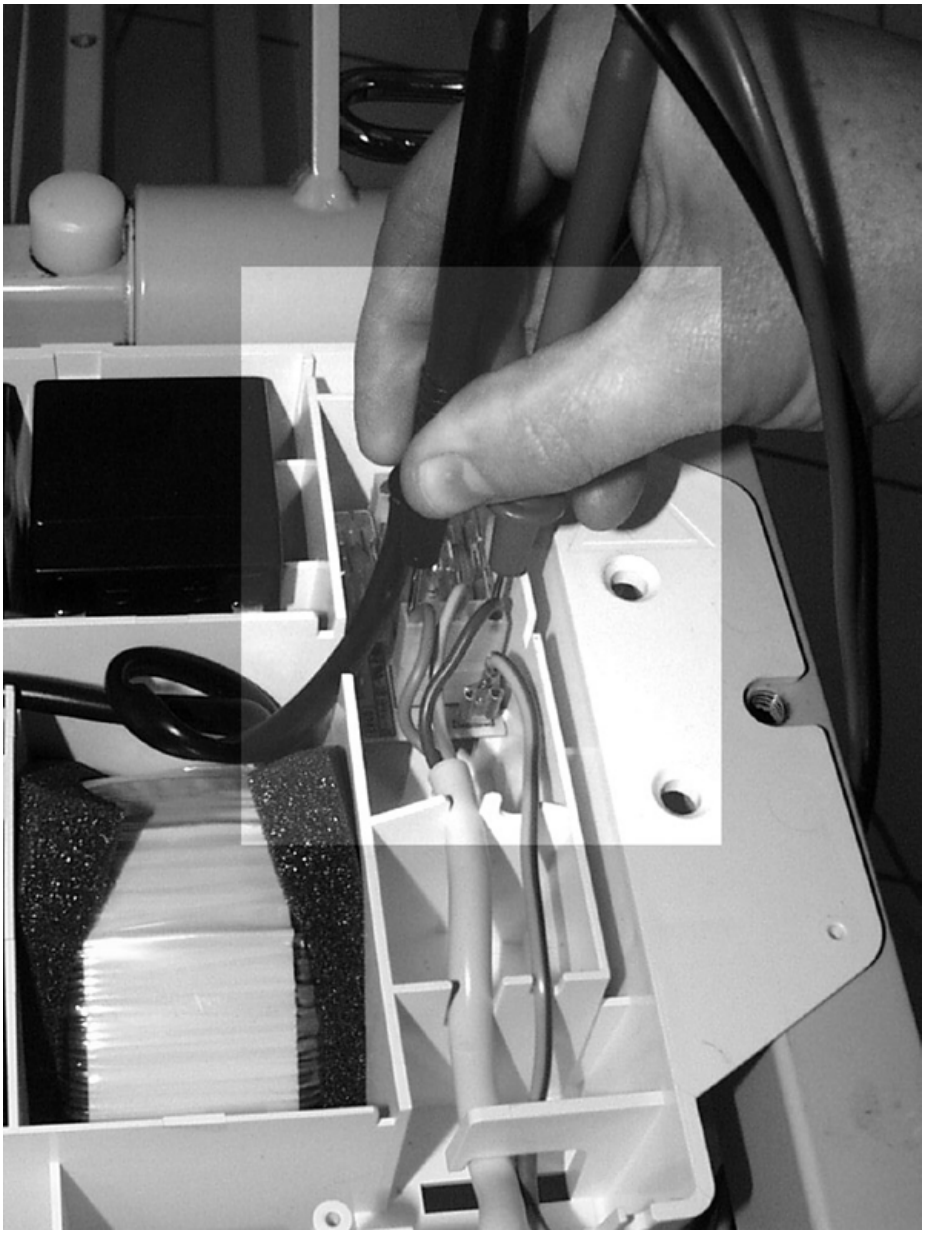
5. Verifiy that the remote control functions properly: Connect the test CU (P/N AG0061, see “Appendix” on page 2-12).

   The functions are operational.

   Yes **No**
   ↓ → Replace the PSU (refer to procedure 4.5 on page 4-18). If this solves the problem perform the “Final Actions” on page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

6. Go to RAP 2.2 on page 2-16.

Figure 2-1. Measuring the AC Input Voltage



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2.2 Control Unit Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
To access the PSU (see figure 4-9 on page 4-19), and connections (see figure 4-10 on page 4-19).

NOTE:
Comments:

- At the start of this troubleshooting procedure, the CU is connected to the LCU.
- In this RAP, the LCU is called "**X**" by convention, whereas the LCU of the opposite side is called "**Y**."
- The LCU is here understood to mean the Lateral Caregiver Unit and its cables.

1. At least one of the other functions is working (HL, emergency trendelenburg, etc.).

   Yes **No**
   ↓ → Go to RAP 2.1 on page 2-13.

2. Test for an open circuit at the LCU (X). Connect the CU to the other LCU (**Y**). The functions of the CU are working and the LEDs are lit.

   Yes **No**
   ↓ → Go to step 4.

3. Replace the LCU (**X**) (refer to procedure 4.7 on page 4-25). If this solves the problem perform the “Final Actions” on page 2-12, otherwise contact your national Hill-Rom representative, see the last page of this manual.

4. Test the control unit itself.

   a. Disconnect all the CU(s) (control pendant or control panel on a flexible arm).

   b. Connect the test CU (P/N AG0061, see “Appendix” on page 2-12).

   The functions of the CU are working.

   Yes **No**
   ↓ → Go to step 6.

5. Replace the CU - control pendant (refer to procedure 4.2 on page 4-10) or control panel on a flexible arm (refer to procedure 4.3 on page 4-12) according to the options fitted. If this solves the problem perform the “Final Actions” on page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

6. Perform the following to test for a short circuit on the LCU (Y) circuit.

a. Remove the cover of the PSU using the 13 mm combination spanner (see figure 4-8 on page 4-16)

b. Disconnect the LCU (**Y**) (identify the cable by tracing it from the LCU to the connector). Ensure the connector is unlocked before trying to free it.

The functions of the CU are working.

Yes **No**
↓ → Go to step 8.

7. Replace the LCU (**Y**) (refer to procedure 4.7 on page 4-25).

8. Perform the following to test for a short circuit on the LCU (X) circuit.

   a. Reconnect the LCU (**Y**).

   b. Disconnect the LCU (**X**).

   c. Connect the CU to the LCU (**Y**).

   The functions of the CU are working.

   Yes **No**
   ↓ → Replace the PSU (refer to procedure 4.5 on page 4-18). If this solves the problem, perform the "Final Actions" on page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

9. Replace the LCU (**X**).

   This solves the problem.

   Yes **No**
   ↓ → Contact your national Hill-Rom representative (see the last page of this manual).

10. Go to "Final Actions" on page 2-12.

2.3 Function Management Mode Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
To access the PSU (see figure 4-9 on page 4-19), and connections (see figure 4-10 on page 4-19).

NOTE:
Comments:

- The symptom of the fault searched for is: after pressing the function management button of the LCU, none of the LEDs flash (*).
- At the start of this troubleshooting procedure the CU is connected to the LCU; the LCU is called "**X**" by convention, whereas the LCU of the opposite side is called "**Y**."
- LCU is here understood to mean the Lateral Caregiver Unit and its cables which cannot be separated (see parts list in Chapter 5).

NOTE:
The trendelenburg/reverse trendelenburg LEDs and low position HL LED do not flash in the steps that include the asterisk symbol (*).

1. At least one of the other functions is working.

   Yes **No**
   ↓ → Go to RAP 2.1 on page 2-13.

2. Verify the proper connection in LCU (X):

   a. Connect the CU to the other LCU (**Y**).

   b. Press the function management control on the LCU.

   All the LEDs flash (*).

   Yes **No**
   ↓ → Go to step 4.

3. Replace the LCU (**X**) (refer to procedure 4.7 on page 4-25).

4. Perform the following to verify the operation of the control unit.

   a. Disconnect the CU(s) (control pendant or control panel on a flexible arm).

   b. Connect the test CU (P/N AG0061, see “Appendix” on page 2-12).

   c. Press the function management control on the LCU.

   All the LEDs flash (*).

   Yes **No**
   ↓ → Go to step 6.

5. Replace the Control Unit (CU) - control pendant (refer to procedure 4.2 on page 4-10) or control panel on a flexible arm (refer to procedure 4.3 on page 4-12) according to the option fitted.

6. Perform the following to test for a short circuit on the LCU (Y).

   a. Remove the cover of the PSU using the 13 mm combination spanner (see figure 4-9 on page 4-19).

   b. Disconnect the LCU (**Y**).

   c. Press the function management control on the LCU.

   All the LEDs flash (*).

   Yes **No**
   ↓ → Go to step 8.

7. Replace LCU (**Y**) (refer to procedure 4.7 on page 4-25).

8. Perform the following to test for a short circuit test on the LCU (X):

   a. Connect the LCU (**Y**).

   b. Disconnect the LCU (**X**).

   c. Connect CU to LCU (**Y**).

   d. Press the function management control on the LCU.

   All the LEDs flash (*).

   Yes **No**
   ↓ → Replace the PSU (refer to procedure 4.4 on page 4-15). If this solves the problem perform the “Final Actions” on page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

9. Replace the LCU (**X**).

   This solves the problem.

   Yes **No**
   ↓ → Contact your national Hill-Rom representative (see the last page of this manual).

10. Go to “Final Actions” on page 2-12.

2.4 Hilow Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
To access the PSU (see figure 4-9 on page 4-19), and connections (see figure 4-10 on page 4-19).

1. At least one of the other functions is working.

   Yes **No**
   ↓ → Go to RAP 2.1 on page 2-13.

2. Identify the relevant column(s).

   Only one column is not working.

   Yes **No**
   ↓ → Go to step 5.

SHOCK HAZARD:
Electric current flows through the connections when the bed is switched on. Trials conducted under these conditions carry a risk of electric shock. Do not touch any wire or terminal which conducts an electric current otherwise personal injury could result.

3. Swap the connectors #6 and #4 (yellow) on the power supply P.C. board (see table 4-1 on page 4-20).

   The faulty column can now be activated.

   Yes **No**
   ↓ → Replace the defective column: H-Col (refer to procedure 4.12 on page 4-37) or F-Col (refer to procedure 4.13 on page 4-42).

4. Replace the PSU (refer to procedure 4.5 on page 4-18).

5. Perform the following to verify the proper operation of the remote control.

   a. Disconnect the CU(s) (control pendant or control panel on a flexible arm).

   b. Connect the test CU (P/N AG0061, see “Appendix” on page 2-12).

   The functions are working.

   Yes **No**
   ↓ → Go to step 7.

6. Replace the CU—the control pendant (refer to procedure 4.2 on page 4-10) or the control panel on a flexible arm (refer to procedure 4.3 on page 4-12) according to the option.

7. Is the bed is equipped with the optional HL pedal.

Yes **No**
↓ → Go to step 14.

8. The HL fault is only noted on **ONE** HL pedal.

   Yes **No**
   ↓ → Go to step 10.

9. Replace the defective pedal (refer to procedure 4.14 on page 4-48).

10. Verify the operation of the right hand pedal.

    Disconnect the right hand pedal.

    The HL function works from the CU or the other pedal.

    Yes **No**
    ↓ → Go to step 12.

11. Replace the right hand pedal (refer to procedure 4.14 on page 4-48).

12. Verify the operation of the left hand pedal.

    Disconnect the left hand pedal.

    The HL function works from the CU or the other pedal.

    Yes **No**
    ↓ → Go to step 14.

13. Replace the left hand pedal (refer to procedure 4.14 on page 4-48).

14. Perform the following to troubleshoot the PSU or HL columns.

    a. Remove the cover of the PSU using the 13 mm combination spanner (see figure 4-9 on page 4-19).

    b. Connect a HL column simulation connector (P/N AG0062, see "Appendix" on page 2-12) to the socket #6 then #4 of the power board (D) (see figure 4-10 on page 4-19), or by default, a test column (fully working column) with its extension cable.

    The control activates the test system (or the test column).

    Yes **No**
    ↓ → Replace the PSU (refer to procedure 4.5 on page 4-18).

15. Replace the 2 HL columns. H-Col (refer to procedure 4.12 on page 4-37) and F-Col (refer to procedure 4.13 on page 4-42).

    This solves the problem.

    Yes **No**
    ↓ → Contact your national Hill-Rom representative (see the last page of this manual).

16. Go to "Final Actions" on page 2-12.

2.5 Thigh Section Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
To access the PSU (see figure 4-9 on page 4-19), and connections (see figure 4-10 on page 4-19).

NOTE:
Initial conditions: the power-driven FS function works (if this option is fitted on the bed) (see "Function Checks" on page 2-6).

1. At least one of the other functions is working.

   Yes **No**
   ↓ → Go to RAP 2.1 on page 2-13.

2. Perform the following to verify the proper operation of the CU.

   a. Disconnect the CU(s) (control pendant or control panel on a flexible arm).

   b. Connect the test CU (P/N AG0061, see "Appendix" on page 2-12).

   The functions are working.

   Yes **No**
   ↓ → Go to step 4.

3. Replace the CU - control pendant (refer to procedure 4.2 on page 4-10) or control panel on a flexible arm (refer to procedure 4.3 on page 4-12) according to the option.

4. Perform the following to verify the proper operation of the TS actuator.

   a. Remove the cover of the PSU using the 13 mm combination spanner (see figure 4-9 on page 4-19).

   b. Cross-connect the TS and FS actuator connectors (#5 brown & # 2 green) or connect new TS actuator, or connect a TS actuator simulation connector (P/N AG0063, see "Appendix" on page 2-12).

   c. Press the FS keys: raise (G) then lower (H) (see figure 1-11 on page 1-14).

5. The TS function works The actuator rod retracts and opens correctly.

   Yes **No**
   ↓ → The TS actuator is defective. Replace it (refer to procedure 4.10 on page 4-33). If this solves the problem perform the "Final Actions" on page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

6. The PSU is defective. Replace it (refer to procedure 4.5 on page 4-18).

   This solves the problem.

Yes **No**
↓ → Contact your national Hill-Rom representative (see the last page of this manual).

7. Go to “Final Actions” on page 2-12.

2.6 Head Section Malfunction (excluding Automatic Contour)

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
To access the PSU (see figure 4-9 on page 4-19), and connections (see figure 4-10 on page 4-19).

NOTE:
Initial conditions: none.

1. At least one of the other functions is working.

   Yes **No**
   ↓ → Go to RAP 2.1 on page 2-13.

2. Perform the following to verify the proper operation of the remote control.

   a. Disconnect all the CU(s) (control pendant or control panel on a flexible arm).

   b. Connect the test CU (P/N AG0061, see “Appendix” on page 2-12).

   The functions are working.

   Yes **No**
   ↓ → Go to step 4

3. Replace the CU - control pendant (refer to procedure 4.2 on page 4-10) or control Panel on a flexible arm (refer to procedure 4.3 on page 4-12) according to the option.

4. Perform the following to verify the proper operation of the HS actuator.

   a. Press the HS “raise without automatic contour” button and raise the HS to the high position. If this cannot be accomplished electrically, disengage the HS actuator using the CPR handle and raise the HS manually (2 people required).

   b. Remove the cover of the PSU using the 13 mm combination spanner (see figure 4-8 on page 4-16).

   c. Either exchange the HS actuator with a new actuator or connect a HS actuator simulation connector (P/N AG0064, see “Appendix” on page 2-12).

   d. Press the HS “raise” then “lower.”

   The HS function works.

   Yes **No**
   ↓ → The HS actuator is defective. Replace it (refer to procedure 4.8 on page 4-27). If this solves the problem perform the “Final Actions” on page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

5. The PSU is defective. Replace it (refer to procedure 4.5 on page 4-18).

   This solves the problem.

   Yes **No**
   ↓ → Contact your national Hill-Rom representative (see the last page of this manual).

6. Go to “Final Actions” on page 2-12.

2.7 Automatic Contour Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
To access the PSU (see figure 4-9 on page 4-19), and connections (see figure 4-10 on page 4-19).

NOTE:
Initial conditions:

a. The HS function without automatic contour works (see “Function Checks” on page 2-6).

b. The TS function works (see “Function Checks” on page 2-6)

NOTE:
The TS only lowers after pressing the “HS lower” for the **1st** time. To make it lower even **further**, you must first “reset” the function by raising the HS.

1. At least one of the other functions is working.

   Yes **No**
   ↓ → Go to RAP 2.1 on page 2-13.

2. Perform the following to verify the proper operation of the remote control.

   a. Disconnect all the CU(s) (control pendant or control panel on a flexible arm).

   b. Connect the test CU (P/N AG0061, see “Appendix” on page 2-12).

   The functions are working.

   Yes **No**
   ↓ → Go to step 4.

3. Replace the CU - control pendant (refer to procedure 4.2 on page 4-10) or control panel on a flexible arm (refer to procedure 4.3 on page 4-12) according to the option.

4. Operate the actuator in raise mode.

   The TS section rises.

   Yes **No**
   ↓ → Go to step 7.

5. Perform the following to verify the proper operation of the PSU and its correct usage.

   a. Operate the HS raise until the section reaches high position.

   b. Operate the HS lower.

   The HS section lowers.

Yes **No**
↓ → Replace the PSU (refer to procedure 4.5 on page 4-18).

6. The problem is due to incorrect usage.

7. Troubleshoot using the following two possibilities.
   a. A new actuator or a TS and FS actuator simulation connector (P/N AG0063, see “Appendix” on page 2-12) is available. Go to step 8.
   b. A new actuator **or** a TS and FS actuator simulation connector (possible only for power-driven FS option) is **NOT** available. Go to step 12.

8. Troubleshoot with a new actuator or TS and FS actuator simulation connector:

   Perform the following to verify that PSU and TS actuator switch is closed.
   a. Either replace the TS actuator with a new actuator in retracted position, or simulate the TS actuator with the TS and FS actuator simulation connector (P/N AG0063, the switch simulating the actuator < mid-travel) connected to the brown socket #5.
   b. Press the HS raise with automatic contour button (A) (see figure 1-11 on page 1-14).

   If new TS actuator, the TS section rises.

   If TS actuator simulation connector, the "raise" LED lights up.

   Yes **No**
   ↓ → Go to step 10.

9. Replace the TS actuator (refer to procedure 4.10 on page 4-33).

10. Perform the following to verify that the PSU and TS actuator switch is open:
    a. Either connect a new actuator with rod in extended position or a switch simulating actuator to mid-travel position.
    b. Press the HS raise with automatic contour button (A).

    If new TS actuator. The TS section rises.

    If TS and FS actuator simulation connector, the "raise" LED lights up.

    Yes **No**
    ↓ → Replace the TS actuator (refer to procedure 4.10 on page 4-33).

11. Replace the PSU (refer to procedure 4.5 on page 4-18).

12. Perform the following to troubleshoot without a new actuator or simulation tool (possible only if power-driven FS option).
    a. Press the HS raise button (B) until this section reaches the high position.
    b. Press the TS and FS lower buttons (F) until these sections reach the low position.
    c. Press the HS raise with automatic contour button (A).

The TS section raises or lowers until mid-travel then stops.

Yes **No**
↓ → Go to step 14.

13. The problem is due to incorrect usage.

14. Switching the connectors of the TS/FS actuators:

    Switch the connectors of the TS and FS actuators (#2, green and #5, brown)

    a. Press the “FS raise” button (G), the rod of the TS actuator extends fully.

    b. Press the “TS lower” button (F), the rod of the FS actuator retracts fully.

    c. Press the “HS raise” button (A).

    The FS actuator starts up and its rod stops after approximately 15 mm of travel.

    Yes **No**
    ↓ → Replace the PSU (refer to procedure 4.5 on page 4-18). If this solves the problem perform the “Final Actions” on page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

15. Replace the TS actuator (refer to procedure 4.10 on page 4-33).

    This solves the problem.

    Yes **No**
    ↓ → Contact your national Hill-Rom representative (see the last page of this manual).

16. Go to “Final Actions” on page 2-12.

2.8 Battery Backup Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
To access the PSU (see figure 4-9 on page 4-19), and connections (see figure 4-10 on page 4-19).

Initial conditions: the bed works normally when connected to an appropriate power source (see "Function Checks" on page 2-6).

1. Perform the following to verify the proper operation of the control unit.

   a. Disconnect the CU(s) (control pendant or control panel on a flexible arm).

   b. Connect the test CU (P/N AG0061, see "Appendix" on page 2-12).

   The functions of the CU are working.

   Yes **No**
   ↓ → Go to step 3

2. Replace the CU - control pendant (refer to procedure 4.2 on page 4-10) or control panel on a flexible arm (refer to procedure 4.3 on page 4-12) according to the option.

3. Verify the battery pack connections (F) (see figure 4-10 on page 4-19):

   Remove the cover of the PSU using the 13 mm combination spanner (see figure 4-8 on page 4-16).

   The battery pack is properly connected (see table 4-1 on page 4-20).

   Yes **No**
   ↓ → Connect the battery pack properly and go to "Function Checks" on page 2-6.

4. There is a battery charging problem.

   Plug the bed into an appropriate power source and ensure that it remains connected for at least 12 hours without the batteries being used. Unplug the bed afterwards.

   The bed operates correctly on battery backup after charging.

   Yes **No**
   ↓ → Go to step 6.

5. Go to "Final Actions" on page 2-12.

6. Verify the battery backup pack by replacing the battery pack with a new battery pack.

   The bed operates correctly with the new battery backup kit.

Yes **No**

↓ → Replace the PSU (refer to procedure 4.5 on page 4-18). If this solves the problem perform the “Final Actions” on page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

7. Go to “Final Actions” on page 2-12.

2.9 Foot Section Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
To access the PSU (see figure 4-9 on page 4-19), and connections (see figure 4-10 on page 4-19).

NOTE:
Initial conditions: the TS actuator movements are working (retraction and extension) and the actuator (rod) is in extended position.

1. At least one of the other functions is working.

   Yes **No**
   ↓ → Go to RAP 2.1 on page 2-13.

2. Perform the following to verify the proper operation of the remote control.
   a. Disconnect the CU(s) (control pendant or control panel on a flexible arm).
   b. Connect the test CU (P/N AG0061, see “Appendix” on page 2-12).

3. The functions are working.

   Yes **No**
   ↓ → Go to step 5.

4. Replace the CU - control pendant (refer to procedure 4.2 on page 4-10) or control panel on a flexible arm (refer to procedure 4.3 on page 4-12) according to the option.

5. Test the function of the FS actuator intermediate switch.

   The problem only occurs on the chair and TS functions.

   Yes **No**
   ↓ → Go to step 7.

6. Go to step 11.

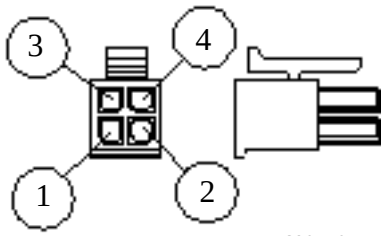
7. Perform the following:
   a. Remove the cover of the PSU.
   b. Cross-connect the connectors of the TS & FS actuators (#5 brown, #2 green) on the power board (see table 4-1 on page 4-20).
   c. Press the emergency release of the sleep surface sections lower button (O) (see figure 1-11 on page 1-14).

   The FS function works, the TS actuator rod extends to mid-travel.

   Yes **No**
   ↓ → The FS actuator is defective. Replace it (refer to procedure 4.11 on page 4-35).

8. Test the function of the TS actuator intermediate switch.
   a. Connect the FS actuator cable to its socket (#2, green).
   b. Either connect new TS actuator in extended position
      – or connect a TS actuator simulation connector RC (P/N AG0063, see “Appendix” on page 2-12) to the socket (#5, brown) on the power board.
      – or using an ohmmeter, check the state of the intermediate switch of the TS actuator. The actuator is extended, the contacts 3 & 4 of the 4-pin connector (socket #5, brown) must be short-circuited (see Figure 2-2 on page 2-32) and with the rod retracted, the circuit must be open.

Figure 2-2. 4-pin Connector



9. The FS function works.

   Yes ↓ **No** → The PSU is defective. Replace it (refer to procedure 4.5 on page 4-18). If this solves the problem perform the “Final Actions” on page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

10. The TS actuator is defective. Replace it (refer to procedure 4.10 on page 4-33), then go to “Final Actions” on page 2-12

11. Test the function of the FS actuator intermediate switch.

    Using an ohmmeter, check the state of the FS actuator intermediate switch.

    - When the rod is extended, contacts 3 & 4 (see Figure 2-2 on page 2-32) of the connector (socket #2, green) must be short-circuited.
    - When the rod is retracted, the circuit must be open.

    The FS actuator intermediate switch is working.

    Yes ↓ **No** → The PSU is defective. Replace it (refer to procedure 4.5 on page 4-18). If this solves the problem perform the “Final Actions” on page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

12. The FS actuator is defective. Replace it (refer to procedure 4.11 on page 4-35).

    This solves the problem.

Yes **No**
↓ → Contact your national Hill-Rom representative (see the last page of this manual).

13. Go to “Final Actions” on page 2-12.

2.10 Assisted Foot Section Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
Initial conditions: the TS function is working.

1. Verify the attachment of the TS and the FS. Remove the hard surfaces of the TS and FS. Check that the screws, bolts or pins are not damaged, loose or missing from the control lever or the FS gas spring mechanism (refer to assembly diagrams in chapter 5).

   All bolts, screws and pins are secure and undamaged.

   Yes **No**
   ↓ → Replace the missing or damaged parts, then go to "Function Checks" on page 2-6.

2. Perform the following to verify the adjustment of the FS gas spring.

   a. Press the TS raise (E) button until the TS reaches the high position (see figure 1-11 on page 1-14).

   b. Set the TS to high position.

   c. Check that the gas spring release adjustment is correct (refer to procedure 4.20 on page 4-65).

   The adjustment is correct.

   Yes **No**
   ↓ → Adjust the gas spring release (refer to procedure 4.20 on page 4-65), then go to "Final Actions" on page 2-12.

3. The FS gas spring operates correctly.

   Yes **No**
   ↓ → Replace the FS gas spring subassembly and cable and release handle (refer to procedure 4.20 on page 4-65), then go to step 5.

4. Go to "Final Actions" on page 2-12.

5. This solves the problem.

   Yes **No**
   ↓ → Contact your national Hill-Rom representative (see the last page of this manual).

6. Go to "Final Actions" on page 2-12.

2.11 EasyChair™ Automatic Chair Position Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
To access the PSU (see figure 4-9 on page 4-19), and connections (see figure 4-10 on page 4-19).

NOTE:
Initial conditions:

a. The TS function works (see “Function Checks” on page 2-6).

b. The FS function works (see “Function Checks” on page 2-6).

c. The HS with automatic contour function works (see “Function Checks” on page 2-6).

7. At least one of the other functions is working.

   Yes **No**
   ↓ → Go to RAP 2.1 on page 2-13.

8. Perform the following to verify the proper operation of the control unit.

   a. Disconnect the CU(s) (control pendant or control panel on a flexible arm).

   b. Connect the test CU (P/N AG0061, see “Appendix” on page 2-12).

9. The functions are working.

   Yes **No**
   ↓ → The PSU is defective. Replace it (refer to procedure 4.5 on page 4-18). If this solves the problem perform the “Final Actions” on page 2-12, otherwise contact your national Hill-Rom representative, see the last page of this manual.

10. Replace the control unit (CU) - control pendant (refer to procedure 4.2 on page 4-10) or control panel on a flexible arm (refer to procedure 4.3 on page 4-12) according to the option fitted.

    This solves the problem.

    Yes **No**
    ↓ → Contact your national Hill-Rom representative (see the last page of this manual).

11. Go to “Final Actions” on page 2-12.

2.12 Trendelenburg/Reverse Trendelenburg Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
To access the PSU (see figure 4-9 on page 4-19), and connections (see figure 4-10 on page 4-19).

NOTE:
Initial conditions: the HL function works (see "Function Checks" on page 2-6).

1. At least one of the other functions is working.

   Yes **No**
   ↓ → Go to RAP 2.1 on page 2-13.

2. Perform the following to verify the proper operation of the control unit.

   a. Disconnect the CU(s) (control pendant or control panel on a flexible arm).

   b. Connect the test CU (P/N AG0061, see "Appendix" on page 2-12).

   The trendelenburg/reverse trendelenburg function works.

   Yes **No**
   ↓ → The PSU is defective. Replace it (refer to procedure 4.5 on page 4-18). If this solves the problem perform the "Final Actions" on page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

3. Replace the CU - control pendant (refer to procedure 4.2 on page 4-10) or control panel on a flexible arm (refer to procedure 4.3 on page 4-12) according to the option fitted.

   This solves the problem.

   Yes **No**
   ↓ → Contact your national Hill-Rom representative (see the last page of this manual).

4. Go to "Final Actions" on page 2-12.

2.13 Emergency Trendelenburg Function not Working with Bed Connected to AC Power

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
To access the PSU (see figure 4-9 on page 4-19), and connections (see figure 4-10 on page 4-19).

NOTE:
Initial conditions:

a. The trendelenburg/reverse trendelenburg function works (see "Function Checks" on page 2-6).

b. The chair function works (see "Function Checks" on page 2-6).

1. At least one of the other functions is working.

   Yes **No**
   ↓ → Go to RAP 2.1 on page 2-13.

2. Try to activate the emergency trendelenburg function on the other LCU.

   The emergency trendelenburg function works.

   Yes **No**
   ↓ → Go to step 5.

3. Remove the cover of the PSU using the 13mm combination spanner (see figure 4-8 on page 4-16).

   a. Cross-connect the 2 LCU.

   b. Activate the emergency trendelenburg function.

   The emergency trendelenburg function works.

   Yes **No**
   ↓ → Replace the PSU (refer to procedure 4.5 on page 4-18).

4. Replace the LCU (refer to procedure 4.7 on page 4-25).

5. Disconnect the 2 LCU (#1a and #1b, grey).

   – Either reconnect a new LCU and activate the emergency trendelenburg function.

   – Or connect the test control unit (P/N AG0061, see "Appendix" on page 2-12) and press the simulation button of the emergency trendelenburg function.

   The emergency trendelenburg function works.

   Yes **No**
   ↓ → The PSU is defective. Replace it (refer to procedure 4.5 on page 4-18). If this solves the problem, perform the "Final Actions" on

page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

6. Replace the defective LCU (refer to procedure 4.7 on page 4-25).

   This solves the problem.

   Yes **No**
   ↓ → Contact your national Hill-Rom representative (see the last page of this manual).

7. Go to “Final Actions” on page 2-12.

2.14 Emergency Trendelenburg Function not Working with the Bed not Connected to AC Power

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
To access the PSU (see figure 4-9 on page 4-19), and connections (see figure 4-10 on page 4-19).

Initial conditions:

a. The trendelenburg/reverse trendelenburg function works (see “Function Checks” on page 2-6).

b. The chair function works (see “Function Checks” on page 2-6).

c. The emergency trendelenburg function works when the bed is connected to AC power (see “Function Checks” on page 2-6).

1. Check the configuration of the bed.

   The bed is equipped with the battery backup function.

   Yes **No**
   ↓ → Go to step 8.

2. Test the battery backup mode function. Unplug the power connector from its power source, and activate the various locked out functions.

   The functions work with no AC power.

   Yes **No**
   ↓ → Go to RAP 2.13 on page 2-37.

3. Remove the cover of the PSU using the 13 mm combination spanner (see figure 4-8 on page 4-16). Check the connections of the emergency trendelenburg battery pack (G) and the battery backup pack (F) (see figure 4-10 on page 4-19) (see table 4-1 on page 4-20).

   The connections are correct.

   Yes **No**
   ↓ → Connect the battery packs correctly, and perform the “Function Checks” on page 2-6.

4. The battery is not charging properly. Plug the bed into an appropriate power source and ensure that it remains connected for at least 12 hours without using the batteries. Unplug the bed afterwards. Operate the emergency trendelenburg function.

   The emergency trendelenburg function works after charging.

   Yes **No**
   ↓ → Go to step 6.

5. Go to “Final Actions” on page 2-12.

6. Replace the battery pack of the emergency trendelenburg function with a new one (refer to procedure 4.6 on page 4-22).

   The emergency trendelenburg function works.

   Yes **No**
   ↓ → The PSU is defective. Replace it (refer to procedure 4.5 on page 4-18). If this solves the problem perform the “Final Actions” on page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

7. Go to “Final Actions” on page 2-12.

8. Perform the following to verify the operation of the emergency trendelenburg function WITHOUT battery backup.

   a. Remove the cover of the PSU using the 13mm combination spanner (see figure 4-8 on page 4-16).

   b. Check the connections of the battery packs of the emergency trendelenburg function (G) (see figure 4-10 on page 4-19).

   The emergency trendelenburg batteries are properly connected (see figure 4-10 on page 4-19).

   Yes **No**
   ↓ → Connect the battery packs properly and perform the “Function Checks” on page 2-6.

9. Perform the following to eliminate a battery charging problem.

   a. Plug the bed into an appropriate power source and ensure that it remains connected for at least 12 hours without using the batteries. Unplug the bed afterwards.

   b. Operate the emergency trendelenburg function.

   The emergency trendelenburg function works after charging.

   Yes **No**
   ↓ → Go to step 11.

10. Go to “Final Actions” on page 2-12.

11. Perform the following:

    a. Replace the emergency trendelenburg batteries with new ones (refer to procedure 4.6 on page 4-22).

    b. Operate the emergency trendelenburg function.

    The emergency trendelenburg function works.

    Yes **No**
    ↓ → The PSU is defective. Replace it (refer to procedure 4.5 on page 4-18). If this solves the problem perform the “Final Actions” on

page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

12. Go to “Final Actions” on page 2-12.

2.15 Bed Connected to AC Power, Brakes not Applied Detection Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
To access the PSU (see figure 4-9 on page 4-19), and connections (see figure 4-10 on page 4-19).

NOTE:
Initial conditions: the HL function works (see "Function Checks" on page 2-6).

1. At least one of the other functions is working.

   Yes **No**
   ↓ → Go to RAP 2.1 on page 2-13.

2. Perform the following to verify the connection of the BM.

   a. Remove the foot cover.

   b. Check that the BM connector is properly connected to the F-Col connector under the cable cover (F) (see figure 4-22 on page 4-44).

   The function, bed connected to AC power but brake not applied detection, works.

   Yes **No**
   ↓ → Go to step 4.

3. Perform the "Function Checks" on page 2-6.

4. Perform the following to verify the function of the BM.

   a. Disconnect the 2-pin connector at the bottom of the F-Col.

   b. Using a DMM set to ohms at the terminals of the BM, check that the BM operates correctly.

      – Idle (not braked), circuit closed

      – Active (braked), circuit open

   The switch operates correctly.

   Yes **No**
   ↓ → Replace the BM and brake detection cabling subassembly (refer to procedure 4.15 on page 4-50), then go to to "Final Actions" on page 2-12).

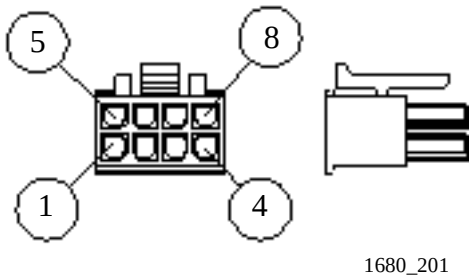
5. Perform the following to verify the cabling of the F-Col.

   a. Reconnect the 2-pin connector to the bottom of the F-Col.

   b. Disconnect the F-Col extension (B) in the central rail of the bed frame (see figure 4-21 on page 4-43).

c. The same verification applies to the terminals of the 8-pin connector in the central rail of the bed frame by checking the operation of the BM from terminals 1 and 6 of the F-Col (see figure 2-3 on page 2-43).

Figure 2-3. 8-pin connector



The column cabling and BM continuity is correct.

Yes **No**
↓ → Replace the F-Col (refer to procedure 4.13 on page 4-42), then go to "Final Actions" on page 2-12.

6. Perform the following to verify the F-Col extension.

   a. Remove the cover of the PSU using the 13mm combination spanner (see figure 4-8 on page 4-16).

   b. Disconnect connector #3 (8-pin blue) on the power board (D) (see figure 4-10 on page 4-19).

   c. The same verification applies to the terminals of connector #3 (8-pin blue) at the level of the PSU by checking the operation of the BM from terminals 1 and 6 (see figure 2-3 on page 2-43) of the F-Col extension connector.

   The extension, column cabling, and switch continuity are correct.

   Yes **No**
   ↓ → Replace the F-Col and extension subassembly (refer to procedure 4.13 on page 4-42). If this solves the problem perform the "Final Actions" on page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

7. Replace the PSU (refer to procedure 4.5 on page 4-18).

   This solves the problem.

   Yes **No**
   ↓ → Contact your national Hill-Rom representative (see the last page of this manual).

8. Go to "Final Actions" on page 2-12.

2.16 CPR Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
Initial conditions: the HL function works (see "Function Checks" on page 2-6).

1. Check the mechanics of the CPR system.

   Remove the hard surfaces of the SS, the TS and the FS (refer to procedure 4.1 on page 4-5). Check that the screws or pins are not damaged or missing from the release handles or release mechanism of the HS actuator (refer to the relevant exploded view of chapter 5).

   All the pins and screws are secure and undamaged.

   Yes **No**
   ↓ → Replace the missing or damaged parts, then go to "Function Checks" on page 2-6.

2. Check that the release cable is not broken.

   The cable is intact.

   Yes **No**
   ↓ → Go to step 4.

3. Check that the adjustment of the release cable is correct (refer to procedure 4.9 on page 4-30).

   The adjustment is correct.

   Yes **No**
   ↓ → Adjust the release cable (refer to procedure 4.9 on page 4-30).

4. Replace the HS actuator (refer to procedure 4.8 on page 4-27) and release cable subassembly (refer to procedure 4.9 on page 4-30).

   This solves the problem.

   Yes **No**
   ↓ → Contact your national Hill-Rom representative (see the last page of this manual).

5. Go to "Final Actions" on page 2-12.

2.17 Foot Siderail Locking/Unlocking Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
Initial conditions: the HL function works (see "Function Checks" on page 2-6).

1. Perform the following to check the foot siderail support.
   a. Remove the hard surfaces of the TS and the FS.
   b. Check that the screws, pins and circlips are not damaged or missing from the foot siderail support mechanism.

   All the screws, pins and circlips are secure and undamaged.

   Yes **No**
   ↓ → Replace the missing screws, pins or circlips (refer to the relevant view of chapter 5), then go to "Function Checks" on page 2-6.

2. Check that the foot siderail locks and unlocks correctly.

   The locking/unlocking is correct.

   Yes **No**
   ↓ → Replace the foot siderail support (refer to procedure 4.23 on page 4-72), then go to "Function Checks" on page 2-6.

3. The problem is solved.

   Yes **No**
   ↓ → Contact your national Hill-Rom representative (see the last page of this manual).

4. Go to "Final Actions" on page 2-12.

2.18 Head Siderail Locking/Unlocking Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
Initial conditions: the foot siderails are working (see "Function Checks" on page 2-6).

1. Check the locking and unlocking of the head siderail of the bed.

   Set the foot siderail to folded position. Check that the screws, pins and circlips are not damaged or missing from the locking mechanism (refer to the corresponding view of chapter 5).

   All the screws, pins and circlips are secure and undamaged.

   Yes **No**
   ↓ → Replace the missing parts (refer to the corresponding view of chapter 5), then go to "Function Checks" on page 2-6.

2. Check that the siderail locks and unlocks correctly.

   The locking/unlocking is correct.

   Yes **No**
   ↓ → Replace the head siderail and the elevation arm subassembly (refer to procedure 4.21 on page 4-68).

3. The problem is solved.

   Yes **No**
   ↓ → Contact your national Hill-Rom representative (see the last page of this manual).

4. Go to "Final Actions" on page 2-12.

2.19 Braking Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
Initial conditions: none

1. Check the caster attachment. Check that the screws or supports are not damaged, loose or missing from the caster attachments (refer to the assembly diagrams of chapter 5).

   All the supports and screws are secure and undamaged.

   Yes **No**
   ↓ → Replace the missing parts (refer to the corresponding view of chapter 5), then go to “Function Checks” on page 2-6.

2. Check the brake bar. Set the brake/steer bar to brake position, then check that the four casters are locked by trying to move the bed.

   The braking is correct.

   Yes **No**
   ↓ → Adjust the caster(s) (refer to procedure 4.17 on page 4-56), then go to “Final Actions” on page 2-12.

3. The problem is solved.

   Yes **No**
   ↓ → Replace the defective caster(s) (refer to procedure 4.17 on page 4-56). If this solves the problem perform the “Final Actions” on page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

4. Go to “Final Actions” on page 2-12.

2.20 Steering Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

NOTE:
Initial conditions: none.

1. Check the caster attachment.

   Set the brake/steer bar to brake position. Check that the screws or supports are not damaged, loose or missing from the caster attachments, (refer to the assembly diagrams of chapter 5).

   All the supports and screws are secure and undamaged.

   Yes **No**
   ↓ → Replace the missing parts (refer to the corresponding view of chapter 5), then go to “Function Checks” on page 2-6.

2. Check the steering function. Set the brake/steer bar to steer position, push the bed lengthways and check that the head right caster locks in the lengthways direction of the bed.

   The caster locks in the lengthways direction.

   Yes **No**
   ↓ → Replace the caster (refer to procedure 4.17 on page 4-56). If this solves the problem perform the “Final Actions” on page 2-12, otherwise contact your national Hill-Rom representative (see the last page of this manual).

3. The problem is solved.

   Yes **No**
   ↓ → Contact your national Hill-Rom representative (see the last page of this manual).

4. Go to “Final Actions” on page 2-12.

2.21 5th Wheel Steering Malfunction

NOTE:
Identification of components: (see figure 3-1 on page 3-3).

Initial conditions: none.

1. Check the attachment of the 5th wheel.

   Check that the screws or supports are not damaged, loose or missing from the support (5th wheel) and caster attachments, (refer to the assembly diagrams of chapter 5).

   All supports and screws are secure and undamaged.

   Yes **No**
   ↓ → Replace the missing or damaged parts, then go to "Function Checks" on page 2-6.

2. Check the 5th wheel. Push the bed lengthways and check that the articulated arm supporting the 5th wheel locks in the lengthways direction of the bed.

   The articulated arm locks in the lengthways direction.

   Yes **No**
   ↓ → Go to step 7.

3. Move the bed several metres and check that the 5th wheel remains in contact with the floor.

   The 5th wheel remains in contact with the floor.

   Yes **No**
   ↓ → Go to step 7.

4. Push the bed sideways and check that the articulated arm supporting the 5th wheel unlocks.

   The articulated arm unlocks correctly.

   Yes **No**
   ↓ → Go to step 7.

5. The problem is solved.

   Yes **No**
   ↓ → Contact your national Hill-Rom representative (see the last page of this manual).

6. Go to "Final Actions" on page 2-12.

7. Replace the support and caster subassembly (refer to procedure 4.17 on page 4-56).

   The problem is solved.

Yes **No**
↓ → Contact your national Hill-Rom representative (see the last page of this manual).

8. Go to “Final Actions” on page 2-12.

Chapter 3
Theory of Operation

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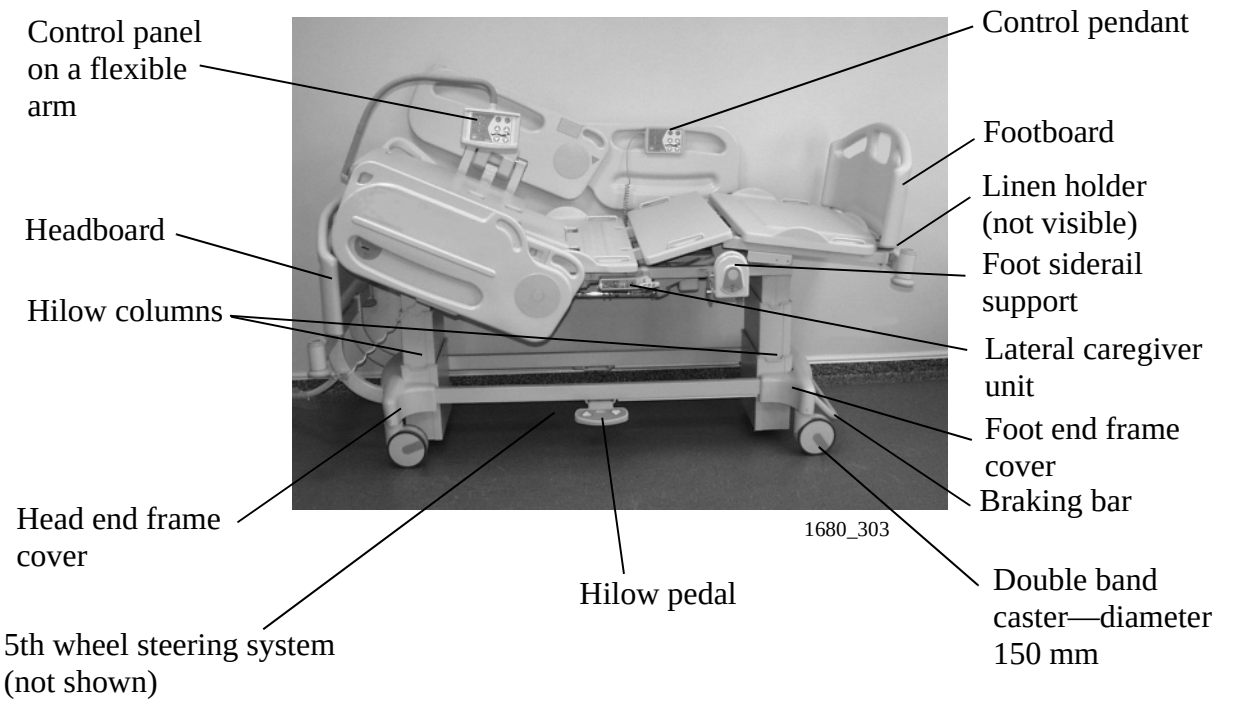
Component Positioning and Electrical Diagrams - LI158Ax/LI159Ax

Figure 3-1. Component Positioning - LI158Ax/LI159Ax



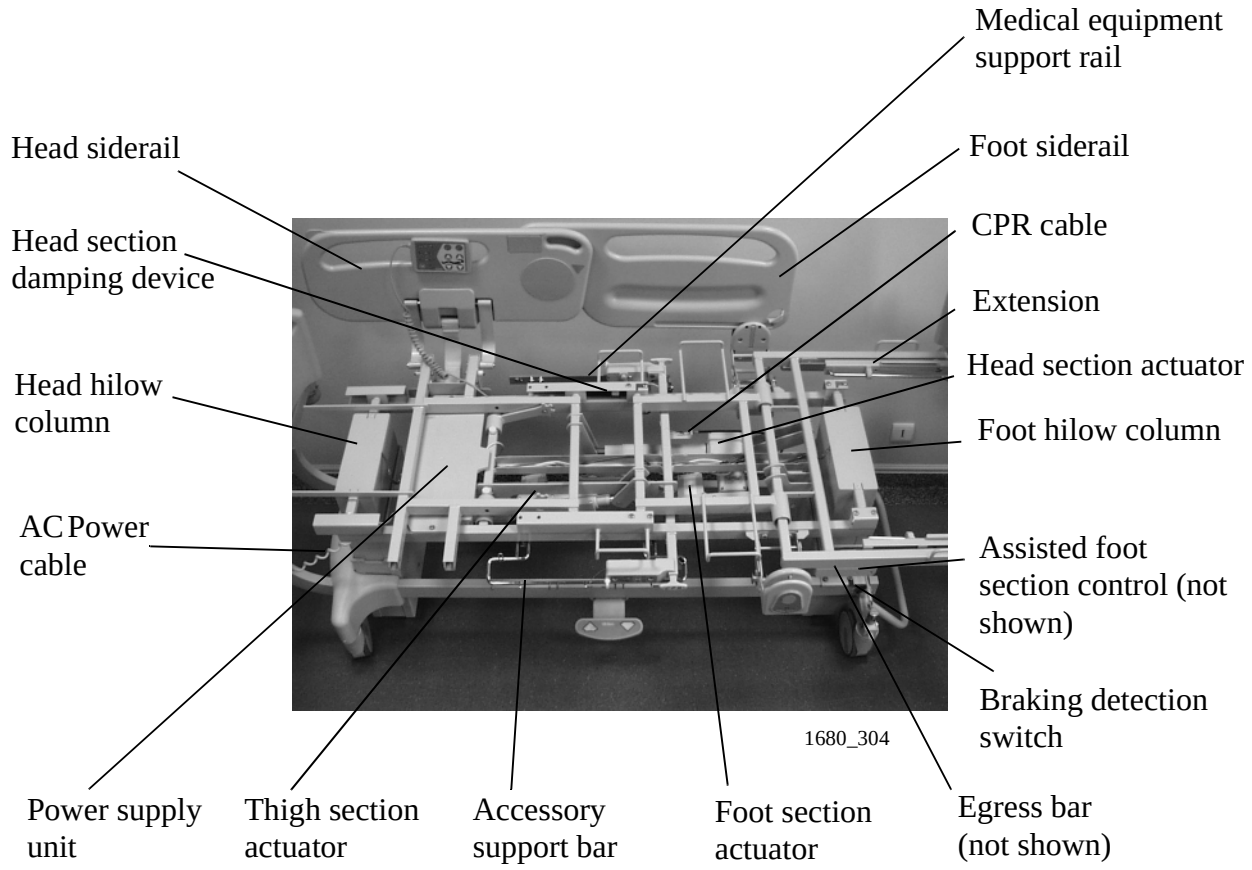
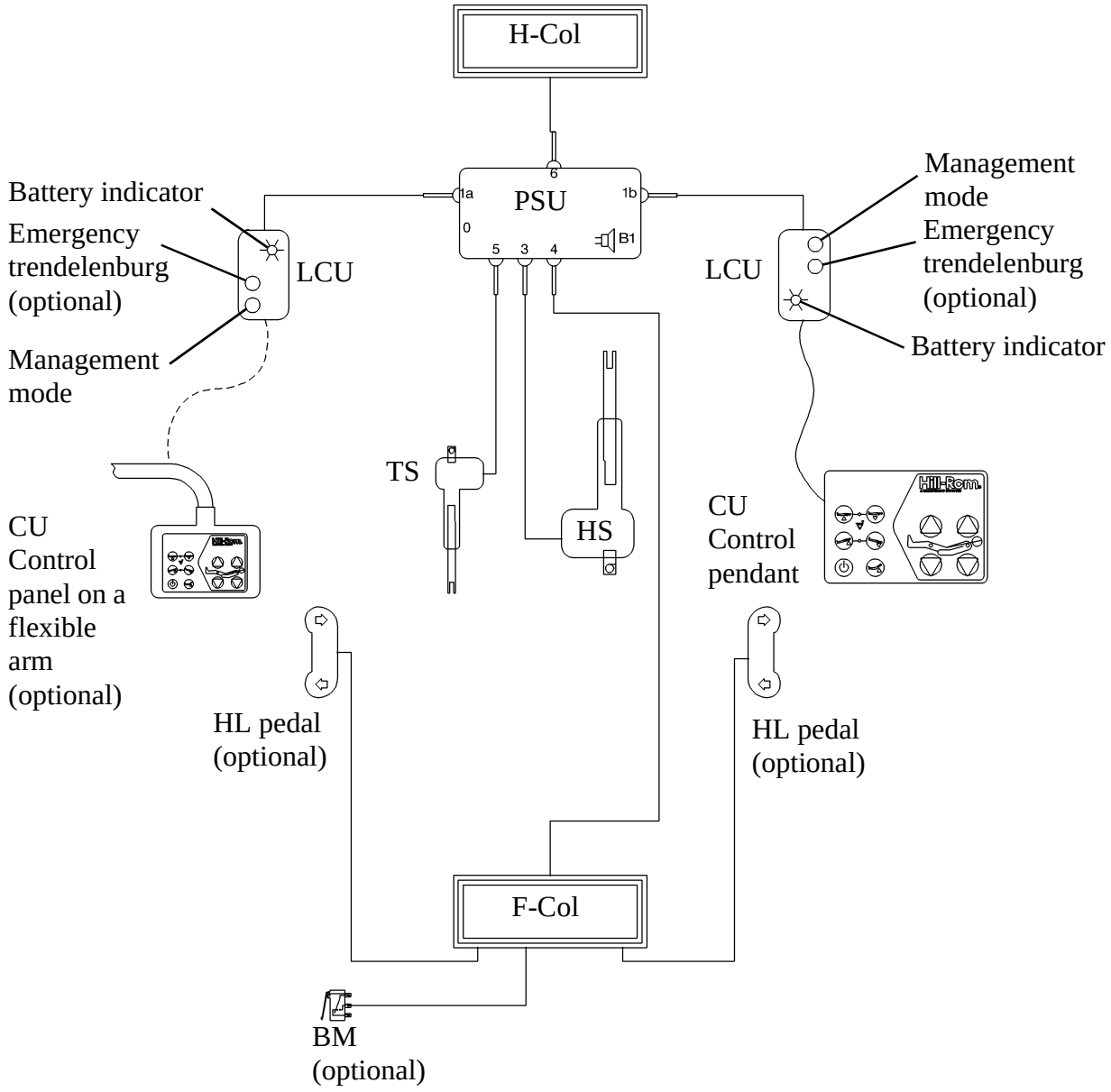
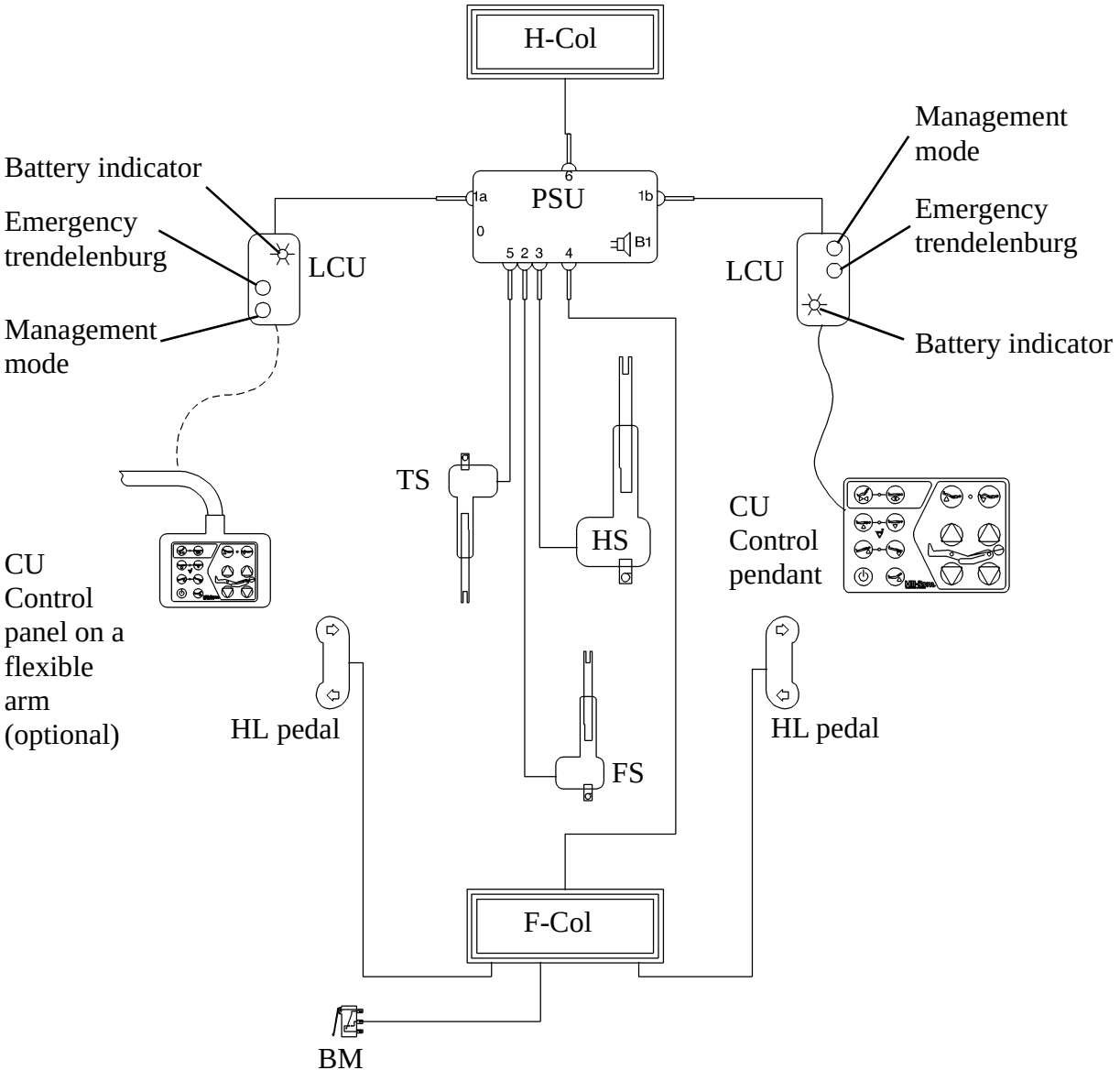


Figure 3-2. Wiring Schematic for LI158Ax



1680_300

Figure 3-3. Wiring Schematic for LI159Ax



Theory of Operation

The operation of the AvantGuard™ Electric Bed is divided into 2 sub-systems:

- Electrical
- Mechanical

The interaction between these sub-systems allows all the operational functions to be used.

The electric functions are driven by low voltage actuators.

Each of the sub-systems is described separately in the following sections. The schematic diagrams are located at the beginning of this chapter.

Mechanical System

The mechanical sub-system consists of two connected systems:

- Bed frame
- Sleep surface

Retractable Head Section

The retractable head section feature is achieved by controlling a sliding movement of the HS frame with two sliding blocks in channels at each side of the intermediate frame which causes the HS frame to extend (with respect to the SS). The hard surface also extends (with respect to the HS frame) towards the head end; this is achieved by the two elevation arms of the HS frame that terminate in gear teeth interfaced with the notches in the rear of the HS hard surface and move the hard surface towards the head end as the HS is raised.

CPR Emergency Release

The CPR release handle, located on either side under the sleep surface adjacent to the LCU, enables the driving gear of the head section motor inside the actuator to be disengaged. This allows the head section to drop under the pull of gravity, assisted/cushioned by a two gas springs.

Assisted Foot Section

The LI158Ax bed features a gas spring assisted foot section. The movement is controlled by the lever situated to the right of the sleep surface that is connected via a bouden cable to release the FS, the movement is assisted/cushioned by a gas spring.

Hilow

The hilow system features two columns each composed of three sections that slide in relation with each other by a pantograph system. This system is driven by a motor fixed at the base of the mechanism. This system enables a travel of 400mm to be obtained. Upper and lower End Of Travel (EOT) switches that are backed up ensure electrical security. The system does not require any special maintenance during its designed period of use (see “Preventive Maintenance” on page 6-5). Consequently, the columns can be replaced in the event of a failure but never dismantled or repaired except by Hill-Rom personnel.

Casters

The bed has four casters, three brake and one brake/steer, each with a 30° inclination activation mechanism and three positions:

- Brake caster: Brake/Neutral/Neutral positions
- Steer caster: Brake/Neutral/Steer positions

Antistatic brake casters are available as an option. They are always fitted in pairs when this option is installed and are identified by a yellow dot on the tyre (single band) or in the centre of each caster (double band). They are located to the left (if the steering caster is on the right hand of the head end) or to the right of the sleep surface (if the steering caster is on the left hand of the foot end).

Braking

The braking system comprises four brake casters controlled by two hexagonal bars with a connecting bar situated in the righthand box-section of the lower frame. The brake control bar is directly mounted on the foot end hexagonal bar of the bed.

Steering

The head end caster on the right, viewed by the patient (or foot end left: optional), is a steering caster. It is also controlled by the brake/steer bar.

5th Wheel Steering System

This automatic steering system comprises a support crossbar fitted across the lower frame and an articulated mechanism that supports a 100mm diameter caster. This mechanism contains two articulations:

- The upper articulation enables the longitudinal indexing of the mobile subassembly. This indexing is obtained by the pressure of two opposing cams around the vertical rotation axis. The pressure results from the presence of a spring in the mobile part. The mobile subassembly can be rotated as soon as a significant lateral force is exerted, creating a torque at the level of the vertical rotation axis and compensating for the resulting force of the cams.
- The lower articulation of the mobile part, combined with the gas spring, enables doorway thresholds to be passed without incident.

NOTE:
If this 5th wheel steering system is installed on the bed, the four casters are identical. There is no steer caster fitted and the braking bar only has two postions: neutral or braked.

TotalGuard™ Integral Siderail Construction

The siderail subassemblies comprise two head and foot sections in fire-resistant extruded/blow-moulded polypropylene and a metal support of the malleable parallelogram type.

- Each head siderail integrates a double security release system.
- The siderail is lowered by sliding the unlocking button and slightly pushing the siderail inwards. This last action enables the catch to slide within its support and is designed to prevent a sudden unintended release.
- Each foot siderail is secured to the corresponding head siderail by a system of clips made of injection moulded plastic that enable rotation. Attachment and removal of the foot siderail is only possible when the siderail is folded onto the head siderail.
- The metal supports consist of three articulated arms: one central arm and two lateral arms.

The siderails and supports thus form a single unit.

Foot Siderail Supports

The foot siderail supports are retractable mechanisms integrating a catch for locking and unlocking the foot siderail.

Head and Footboards

The head and footboards feature an extruded/blow-moulded plastic structure with chrome-plated steel clasps for assembly and decorative laminated panels.

Electrical System

The specifications of the bed are as follows:

Table 3-1. Specifications of the LI158Ax/LI159Ax Bed

Description	Specification
Type	AvantGuard™ Electric Bed
Reference	LI158Ax, LI159Ax
Type of protection against electric shock (according to IEC 60601-1)	Class I
Degree of protection against electric shock (according to IEC 60601-1)	Type B
Protection against harmful ingress of water (according to IEC 60529)	IPX4
Intermittent operation	10% 3 min/30 min
Voltage	230V (+10%, -15%) AC voltage and earth
Frequency	47-52 Hz
Maximum power load	360 VA

Refer to the schematic diagram at the beginning of this section to obtain specific information for the cabling.

The bed is operated by a PSU. This unit controls the electric functions of the bed: hilow (H-Col and F-Col), HS and TS with automatic contour (see figure 3-2 on page 3-4), including the FS (depending on the model) (see figure 3-3 on page 3-5).

These functions are performed by actuators using very low voltages.

Power Supply Unit Characteristics

Table 3-2. Power Supply Unit Characteristics

Description	Specification
Input characteristics	(see table 3-1 on page 3-10)
Fuse rating on primary	2 AT
Maximum power load	360 VA
Output voltage	18 to 40 V rectified, filtered
Output power	360 VA
Intermittent operation	10% 3 min. every 30 min.

The power supply unit comprises of the following main sections:

- Power stage
- Functions controlled by relays and transistors
- Battery charging circuit
- Control logic and specific functions

The functions are activated after electronically unlocking each of them by using one of the following:

- Control pendant
- Control panel on a flexible arm
- Lateral caregiver unit
- Hilow pedal (HL only) (option or accessory)

Power Stage

The power stage is composed of a 230VAC transformer, protected at the input by 2 antisurge fuses of 2A, followed at the output by a bridge rectifier and filter capacitor. The output voltage VDC1 is is approximately 24VDC and unregulated and depending on the power required. The transformer is also protected by an internal thermal cutout that **cannot be reset**. The available power enables several functions to be controlled simultaneously.

The VDC1 also passes through two regulators that supply voltages VDC2 = 15VDC (±3V) for the analogue components (comparators, battery charging control circuit, etc.) and VDC3 = 3.3VDC (±10%) for the logic components (control pendant, etc.).

The power stage is also protected against electrostatic discharges (ESD) of 20kV**.**

Function Control

The actuators are controlled by relays. In order to protect these relays from electrical sparks during switching, the second FET transistor checks the delay power when a function is activated, thus allowing the switches to close with no voltage. In the same way, when a function control is released, the FET transistor cuts the power before the contact opens.

Overload limiting: This is provided by permanently controlling the current at the output of each motor. In the event of overload or mechanical blockage, the supply of the relevant motor is cut off by a control transistor without affecting the operation of the other motors, except for specific situations. In this case, the overload is indicated by an audible alarm. This overload indication also enables failure of a actuator end of travel to be detected, except for the HL columns, which have a backup end of travel.

Battery Circuit

The bed can be fitted with a battery backup (optional) and/or an emergency trendelenburg function battery backup (optional). These batteries are internal to the power supply unit. The emergency trendelenburg function battery is only available for this specific function. The common charging circuit, situated in the power supply unit, has current limiting according to the level of the battery charge. Charging begins as soon as the unit is switched on. At the end of charging, the load current is very low.

When the PSU is disconnected from the AC power, battery operation is activated by the “Battery Activation” on the control pendant.

The battery charge level is controlled. In this way, a flashing LED and an audible low battery alarm by buzzer are activated during movement if the battery voltage drops (this is a continuous beep of several seconds that is heard each time a button is pressed).

After reconnecting to the power outlet, this LED continues to flash until the battery has recharged.

Battery operation is automatically inhibited 30 seconds after the end of the last movement.

Battery Characteristics

Table 3-3. Battery Backup Characteristics

Description	Specification
Components	2 components of 12V
Capacity of each component	1.2Ah
Voltage	24VDC
Maximum charging time	12 hours
Discharging time (storage), battery connected to bed	Minimum 10 days
Discharging time (storage), battery not connected to bed	3 months

Table 3-4. Emergency Trendelenburg Function Battery[1] Characteristics

Description	Specification
Components	2 components of 12V
Capacity of each component	0.7Ah
Voltage	24VDC
Maximum charging time	10 hours

Description	Specification
Discharging time (storage), battery connected to bed	Minimum 10 days
Discharging time (storage), battery not connected to bed	3 months

These are sealed lead acid batteries connected in series on the main board and protected by fuses on the connection wires.

This battery type has no memory effect and can thus be recharged regularly without any particular constraints.

Reminder concerning the memory effect: Some batteries types (e.g.: nickel cadmium) must be fully discharged before being recharged. Failure to observe this precaution will significantly reduce their lifetime.

The capacity of the battery backup after full charging: is a minimum of 3 raise and lower cycles for HL, HS, TS and FS (optional) with the safe working load on the bed (185kg).

The capacity of the emergency trendelenburg function battery after full charging is a minimum of 3 emergency trendelenburg position cycles from the full reverse trendelenburg position and HS in high position, with the safe working load on the bed (185kg).

Control Logic and Specific Functions

- Combined activations of the actuators provide the following functions:
  - Emergency trendelenburg (see “Emergency Trendelenburg Function” on page 3-16)
  - EasyChair
  - Automatic contour
  - Emergency trendelenburg function
- Lockout management
- Control unit interfacing
- Indication of Bed Not in Low Position (see “Detection of Bed not in Low Position” on page 3-15)
- Indication of Bed Connected to AC Power but Brakes not Applied (see “Detection of Bed Connected to AC Power but Brakes not Applied (Optional Depending on the Model)” on page 3-16)

1. The emergency trendelenburg function battery is only fitted if the emergency trendelenburg option AND the optional battery backup are fitted.

All of these functions are integrated into a CPLD (Complex Programmable Logic Device).

Control Pendant

The control pendant is available in two configurations depending on the bed model. Each unit operates at 3.3VDC supplied by the power card and integrates three main principles:

- Filtering and amplification of inputs for electrostatic protection and signal formatting
- Multiplexing for the management of the buttons
- Demultiplexing for the control of the LEDs

Data from the buttons and LEDs are transmitted in series (link type - SPI) so as to reduce the number of wires. The clock signal that enables these exchanges is controlled by the power card. All the data is sent in tens of milliseconds. When the system is in standby mode, the power is cut off and the clock signal is no longer controlled. The battery mode activation button is therefore directly wired so as to be continually operational.

Control Panel on a Flexible Arm

The control panel on a flexible arm is available in two configurations, just like the control pendant and is identical in design.

Lateral Caregiver Unit

The LCU is available in two configurations depending on whether or not the emergency trendelenburg function is available. This unit is situated on either side under the sleep surface and has one opening, (two openings when the emergency trendelenburg function is fitted) for the LCU key, a charging indicator for the battery function and a connector for the control pendant or control panel on a flexible arm. Each opening has a NO switch that activates function management and trendelenburg/reverse trendelenburg functions and the emergency trendelenburg function for the other opening. A single 12-wire bundle connected to the PSU groups the various signals.

NOTE:
The LCU is only available as an assembly which includes the wiring harness, switches and connections.

Motor Characteristics

The motors have the following characteristics:

Table 3-5. Motor Characteristics and Dimensions

Description	HL column motor	HS motor	TS motor	FS motor
Power	96 W (x2)	120 W	84 W	84 W
Voltage	18 to 40VDC	18 to 40VDC	18 to 40VDC	18 to 40VDC
Intermittent service	10% 3min/30min	10% 2min/18min	10% 6min/60min	10% 6min/60min
Actuator/ column travel	400 mm ± 5mm (15.75")	252 mm ± 2mm (9.91")	60 mm ± 2mm (2.36")	45 mm ± 2mm (1.77")
Retracted rod/ centre distance		458 mm ± 2mm (18.03")	310 mm ± 2mm (12.2")	325 mm ± 2mm (12.8")

Management of the Actuators

The actuators are supplied by the power supply unit. Their extreme positions are detected by upper and lower internal EOT devices, in series. These devices directly cut off the power supply for the head section, thigh section and foot section actuators. In addition, the head section and foot section actuators have intermediate internal microswitches in order to control the automatic contour and chair position.

The two hilow columns also have upper and lower internal EOT devices. For safety reasons, they are both backed up at each end. If one of these safety EOTs is activated the column cannot be used. The other functions remain operational.

WARNING:
The column must be replaced if it becomes defective. The column must never be dismantled. Failure to observe this warning could result in personal injury.

Complementing these EOTs, the overload limiting function of the PSU provides protection in the event of mechanical failures, obstacles or overload.

Detection of Bed not in Low Position

This type of detection is obtained by taking into account the state of the low EOT of the HL columns. The power supply unit controls the corresponding LED of the control unit as soon as one of the two EOTs is released.

Automatic Contour

The PSU, when it received a command from the CU, controls the automatic contour (HS and TS) operation of the bed. This function is carried out through an intermediate switch of the TS actuator. When the HS raise function is activated from the horizontal position, the HS and TS rise immediately until the intermediate internal microswitch of the TS actuator cuts its power at approximately 20°. The HS actuator continues to work until its upper EOT is reached or when the control is released. When the head section lower function is activated and the corresponding section reaches the low position, the TS actuator is controlled for lowering until its lower EOT is reached or the control is released.

EasyChair™ Automatic Chair Function

This function combines the movements of the bed frame sections and uses the intermediate internal microswitches of the TS and FS actuators to control the interaction between these two sections.

Emergency Trendelenburg Function

When the emergency trendelenburg control is activated by the LCU key on the LCU, the PSU simultaneously moves the TS and FS to horizontal and adjusts the sleep surface to the trendelenburg position. The two columns will be controlled until the maximum trendelenburg is reached, or for as long as the control is activated. The movement stops when the EOTs are reached. The battery dedicated to this function guarantees movement when there is no AC power but is independent from the battery backup. However, the battery charging circuit is common.

Detection of Bed Connected to AC Power but Brakes not Applied (Optional Depending on the Model)

The system operates by an NO switch mounted on the foot end crossbar and is activated by the braking hexagonal bar. The PSU controls an audible beep if the following two elements occur together: AC power present and switch not activated. The beep only stops when the brake is applied or when the power connector is unplugged from the power outlet.

Trendelenburg/Reverse Trendelenburg

This fully electric function can only be accessed by the caregiver. The function is enabled by the LCU key on the LCU and activated via the CU. The principle involves controlling the two hilow columns in opposing directions according to the position required, irrespective of the initial height and position of the sleep surface. As long as one of the two buttons remains pressed, the two columns continue to move until their internal EOT is reached. The maximum inclination can therefore be reached as long as AC power or battery backup is available.

NOTE:
The warranty will be rendered null and void if any electrical component is opened, except where the PSU cover is removed by authorised personnel.

NOTES:

Chapter 4
Removal, Replacement and Adjustment Procedures

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NOTES :

4.1 Bed Frame Hard Surface Replacement

Time required: 10 min

Number of people: 1 (plus 1 occasionally)

Possibility of intervening with patient on the bed: No

Tools required: #2 phillips head screwdriver—control panel on a flexible arm only

Removal

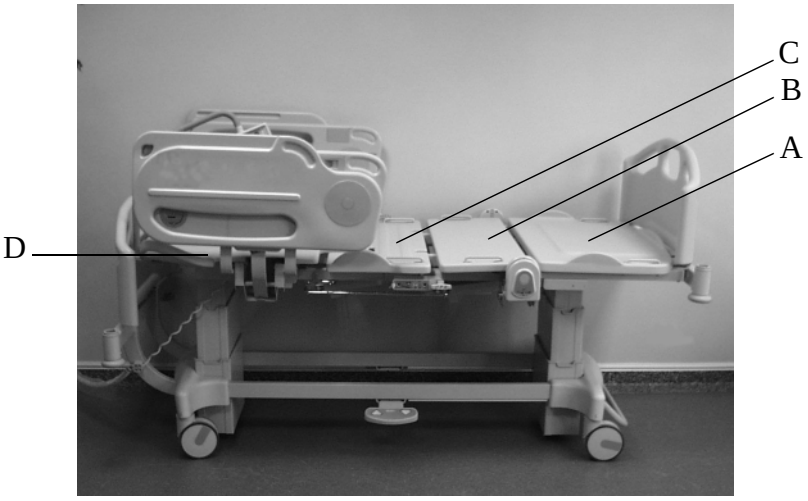
1. Apply the brakes, raise the sleep surface and the HS to the high position, lower the TS and the FS to horizontal. Raise and lock the siderails with the foot siderails folded.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

2. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

3. For the FS hard surface, remove the footboard from the bed, then grip the foot hard surface on either side of the sleep surface (A) at the restraining strap attachment handles then remove the surface by tilting it towards the foot end of the bed (see figure 4-1 on page 4-5).

Figure 4-1. Bed Frame Hard Surface Overall View



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4. For the TS hard surface, grip the hard surface (B) on either side of the sleep surface and remove it from the bed.

5. For the SS hard surface, grip the hard surface (C) on either side of the sleep surface and remove it from the bed.

CAUTION:
The head section must always be horizontal when removing or fitting the head section hard surface. Failure to do so may give rise to an incorrect position and cause the elevation sliding system to malfunction.

6. Perform the following to remove the HS hard surface:

NOTE:
If the bed fitted with a control panel on a flexible arm, it must be removed first (refer to procedure 4.3).

a. Ensure that the SS has been removed, then remove the headboard and lower the HS to horizontal by using one of the CPR controls.

b. Remove the 4 Truarc®[1] circlips on pins (E) and (F) securing the hard surface (D) to the HS and recover the spacers on the two lower Truarc circlips (photo shown with HS section lifted for clarity) (see figure 4-2 on page 4-6) .

Figure 4-2. Installing the Head Section Hard Surface

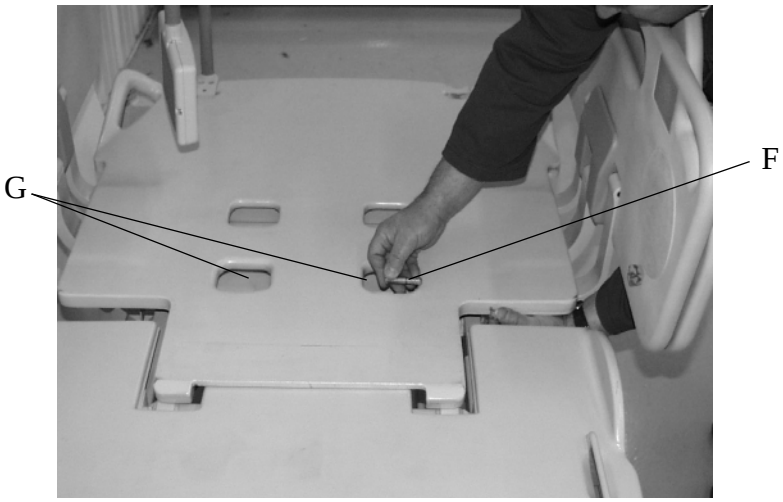
1680_442

c. Pass your hand through the openings (G) of the hard surface and remove the 2 securing pins (F) (see figure 4-3 on page 4-7).

NOTE:
The 2 pins are mounted from the inside to the outside, but they can be reversed.

1. Truarc® is a registered trademark of Waldes Truarc, Inc.

Figure 4-3. Installing the Head Section Hard Surface



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d. Manually move the brackets (H) on each side of the HS hard surface and slightly raise the hard surface (photo shown with HS section lifted for clarity) (see figure 4-4 on page 4-7).

Figure 4-4. Head Section Hard Surface Support

1680_450

e. Remove the hard surface from its supports (I) by lifting it slightly at the base and pulling it towards the head end of the bed (see figure 4-2 on page 4-6).

Replacement

1. Perform the removal procedure in reverse order.

CAUTION:
The head section must always be horizontal when removing or fitting the head section hard surface. Failure to do so may give rise to an incorrect position and cause the elevation sliding system to malfunction.

NOTE:
The SS, TS and FS hard surfaces are supported by the restraining strap attachment points on either side of the sleep surface.

NOTE:
The hard surface of the SS can only be installed when the HS is in high position.

Figure 4-5. Head Section Hard Surface Positioning

1680_422

2. To replace the HS hard surface, perform the following:
   a. Fit the HS hard surface with the HS in the horizontal position.
   b. Insert the two support pins (F) at the head end of the bed with respect to the guide rails (J) (see figure 4-5 on page 4-8).
   c. Pass your hand through the openings (G) of the hard surface and fit the 2 securing pins (F) (see figure 4-3 on page 4-7).
   d. Fit the 4 Truarc® circlips (fit the two spacers to the lower pins) on pins (E) and (F) securing the hard surface (D) to the HS (see figure 4-2 on page 4-6).

WARNING:
Two persons are required to test the articulation of the head section. Disregarding this precaution may result in injuries.

3. Grip the end handles of the HS hard surface, operate one of the CPR handles and raise/lower the HS to check that the hard surface moves without interference.

4. Perform the “Function Checks” on page 2-6.

4.2 Control Pendant

Identification: (see figure 3-1 on page 3-3)

Time required: 5 min

Number of people: 1

Possibility of intervening with patient on the bed: Yes

Tools required: None

Removal

1. Identify the version of the control pendant to be replaced (LI158Ax or LI159Ax) to ensure that the replacement will allow the same functions.

2. If possible, raise the HS, then raise and lock the siderails.

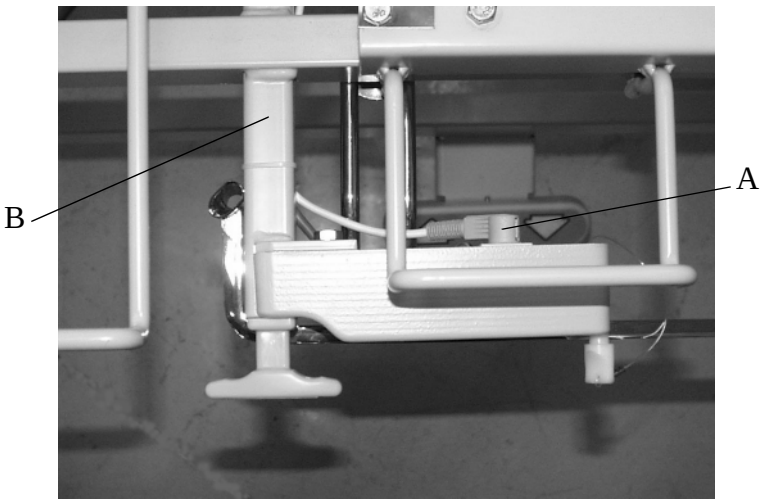
3. Apply the brakes and raise the sleep surface to the high position.

4. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

5. Identify connection (A) of the control pendant on the bed (see figure 4-6 on page 4-11).

NOTE:
This connection can be found both on the right or left of the sleep surface behind the LCU.

Figure 4-6. Control Pendant Connection



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6. Disconnect the connector (A) from the LCU by pulling (no specific locking). The cable does **not** pass through the conduit located under the crossbar (B) (see figure 4-6 on page 4-11).

Replacement

1. Identify the version of the control pendant to be replaced (LI158Ax or LI159Ax) to ensure that the replacement will allow the same functions.

2. Perform the removal procedure in reverse order.

3. Perform the “Function Checks” on page 2-6.

4.3 Control Panel on a Flexible Arm

Identification: (see figure 3-1 on page 3-3)

Time required: 15 min

Number of people: 1 (plus 1 occasionally)

Possibility of intervening with patient on the bed: No

Tools required: #2 phillips head screwdriver

Removal

1. Identify the version of the control panel on a flexible arm to be replaced (LI158Ax or LI159Ax) to ensure that the replacement will allow the same functions.

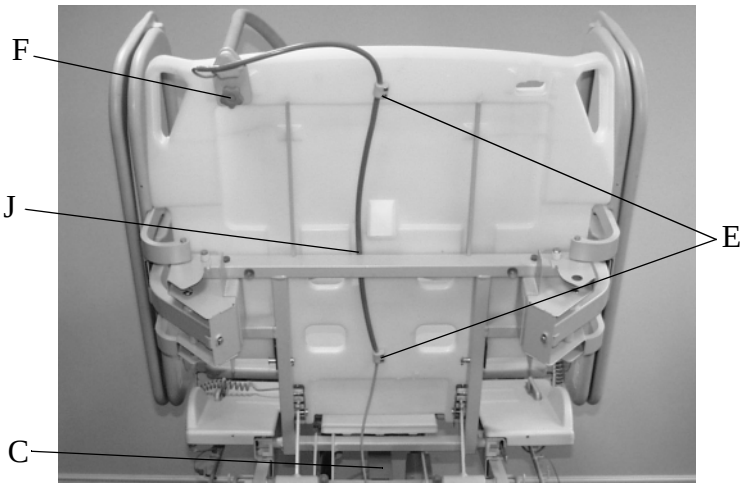
2. Raise the HS to the high position, then raise and lock the siderails, and remove the headboard.

3. Apply the brakes, raise the sleep surface to the high position and lower the sleep surface sections to horizontal.

4. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

5. Identify the assembly of the control panel on a flexible arm on the HS. It is fixed to the hard surface by the knob screw (F), its cable is maintained by the supports (E) and guided by the notch (J) (see figure 4-7 on page 4-13).

Figure 4-7. Installing the Control Panel on a Flexible Arm



6. Remove the hard surfaces of the SS and the TS (refer to procedure 4.1).

7. Remove the cable cover (C) of the central rail of the bed frame and free the cable from the control panel on a flexible arm. Note that the cable must always be fitted with as much play as possible at the level of the HS articulation (see figure 4-7 on page 4-13).

8. Trace the cable to the correct LCU and disconnect the connector (A) from the rear of the LCU (see figure 4-6 on page 4-11).

9. Open the cable track located under the crossbar (B) of the bed frame and free the cable of the control panel on a flexible arm.

10. Using the #2 phillips head screwdriver, loosen and remove the screws from the two supports (E). Remove the supports (see figure 4-7 on page 4-13).

11. Remove the connector of the control panel on a flexible arm from the notch (J) by pushing gently underneath the HS hard surface so as to move the HS frame.

12. Unscrew the knob screw (F) securing the control panel on a flexible arm and remove it from the HS hard surface.

Replacement

1. Identify the version of the control panel on a flexible arm to be replaced (LI158Ax or LI159Ax) to ensure that the replacement will allow the same functions.

2. Perform the removal procedure in reverse order.

CAUTION:
The head section must always be horizontal when removing or fitting the head section hard surface. Failure to do so may give rise to an incorrect position and cause the elevation sliding system to malfunction.

3. Grip the end handles of the HS hard surface, operate one of the CPR handles and raise/lower the HS to check that the hard surface moves without hindrance.

4. Perform the “Function Checks” on page 2-6.

4.4 AC Power Cable

Identification: (see figure 3-1 on page 3-3).

WARNING:
Only the AC power cables listed in chapter 5 can be used on the AvantGuard™ Electric Bed. Other cables may compromise the safety and conformity of the bed.

Time required: 10 min

Number of people: 1

Possibility of intervening with patient on the bed: No

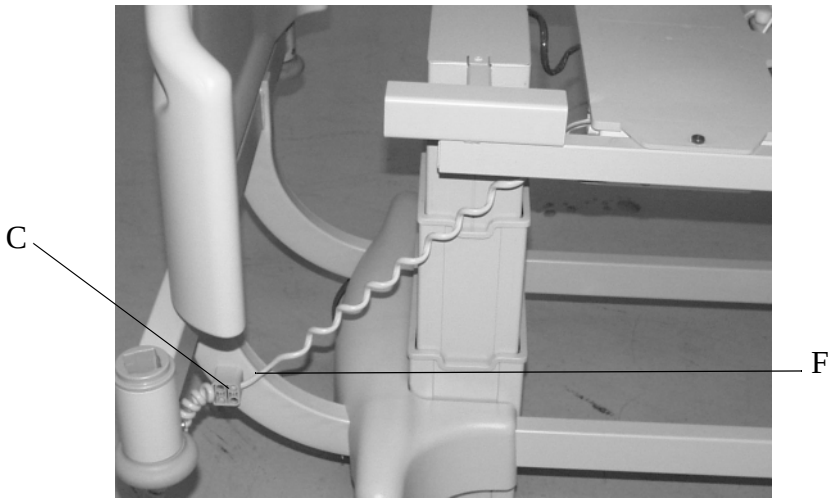
Tools required: #2 phillips head screwdriver
13 mm ratchet wrench

Removal

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

1. Unplug the power connector from the power outlet.
2. Apply the brakes, raise the sleep surface to the high position and lower the sleep surface sections to horizontal. Use the battery supply if possible.
3. Remove the headboard, raise the HS and siderails to the high position. Use the battery supply if possible or the CPR function.
4. Lock out all the functions. If the bed has a battery, wait for about one minute until the battery mode is deactivated. Next, ensure that no LED is lit on the control pendant. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.
5. Using the 13mm ratchet wrench, loosen and remove the two screws (A) securing the cover (B) on the PSU, recover the two screws and remove the cover (B) by unclipping it (see figure 4-9 on page 4-19).
6. Using the medium phillips head screwdriver, remove the two screws securing the strain relief bracket (C) of the AC power cable on the right-hand side (view of patient lying down) of the frame. The AC power cable has a special straight section (F) for its correct positioning with the strain relief bracket (C) (see figure 4-8 on page 4-16).

Figure 4-8. Installing the AC Power Cable



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7. Note the passage of the AC power cable, and the connection of the wires on the AC input terminal (E) inside the PSU (see figure 4-10 on page 4-19).

8. Unclip the AC power cable from the AC input terminal (E).

9. Remove the AC power cable.

Replacement

1. Perform the removal procedure in reverse order, checking that the wires are properly supported at the AC input terminal (E).

2. Adjust the sleep surface to reverse trendelenburg then to trendelenburg to ensure that the AC power cable can extend sufficiently without damage between the PSU and the strain relief bracket.

SHOCK HAZARD:
The equipotential link and the grounding of the metal parts of the bed depend on the correct installation of the earth conductor and grounding spring blades. Personal injury could result if the installation is not correct and/or if the earth continuity is compromised.

3. Check that the earth continuity of the accessible metal parts is correct (see “Earth resistance” on page 6-7 in the Preventive Maintenance Schedule).

SHOCK HAZARD:
An abnormally high leakage current is symptomatic of a degradation within the AC power cable and the PSU. Personal injury could result if the value of the leakage current is above 500 microamperes.

4. Check that the leakage current of the bed is compliant (see “Leakage current” on page 6-8 in the Preventive Maintenance Schedule).

5. Perform the “Function Checks” on page 2-6.

4.5 Power Supply Unit

Identification: (see figure 3-1 on page 3-3)

Time required: 20 min

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 13 mm ratchet wrench

NOTE:
The batteries are not supplied with the PSU. Check the dates shown on the batteries and replace them if they are older than five years.

Removal

1. Apply the brakes, raise the sleep surface to the high position, and the HS to the high position. Raise the siderails to the high position.

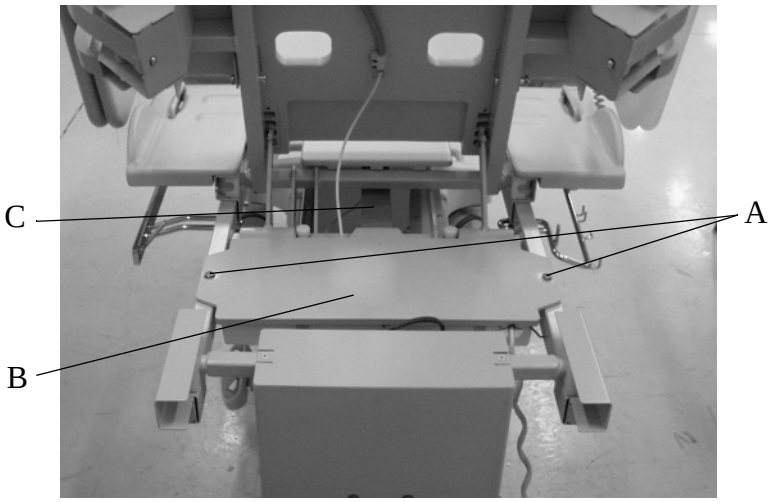
NOTE:
If necessary, use the CPR control to raise the HS.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

2. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

3. Using the 13 mm ratchet wrench, loosen and remove the two screws (A) securing the cover (B) of the PSU, recover the two screws and remove the cover (B) by unclipping it. Note the position of the cable cover (C) (see figure 4-9 on page 4-19).

Figure 4-9. Power Supply Unit Cover



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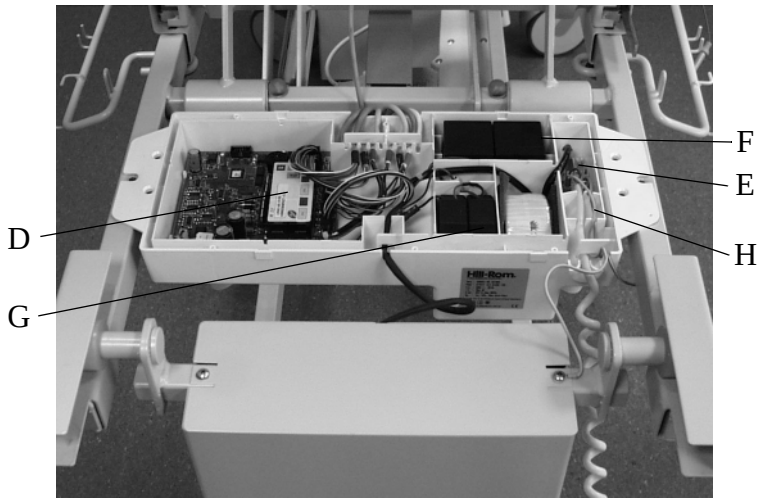
4. Note the passage of the cables in the PSU, and their connection on the main board (D) and the AC input terminal (E) (see figure 4-10 on page 4-19).

Figure 4-10. Power Supply Unit



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5. Free the AC power cable by unclipping it from the AC input terminal (E).

6. Disconnect the various connectors of the main board (D) of the PSU. Mark the different connectors using the colour codes and markings on each connector (see table 4-1 on page 4-20).

Table 4-1. Power Supply Unit Connections

Connector number	Marking	Colour	Identification
0	#0	Red	Not used
1a	#1a	Grey	Right hand LCU
1b	#1b	Grey	Left hand LCU
2	#2	Green	Foot section actuator
3	#3	Blue	Foot section actuator
4	#4	Yellow	Foot hilow column
5	#5	Brown	Thigh section actuator
6	#6	Yellow	Head hilow column

7. Manually crimp the two earth wire terminal connectors (H) of the intermediate frame and the hilow column to the AC input terminal (E) and free the wires (see figure 4-10 on page 4-19).

NOTE:
The figure shows a bed with the 45 to 85 cm HL column for illustration only.

8. If they are fitted, disconnect the cables of the autonomy (F) and emergency trendelenburg function (G) batteries and remove them from the PSU.

9. Remove the PSU from the bed.

Replacement

1. Perform the removal procedures in reverse order.

2. Check the dates shown on the batteries and replace them if they are older than five years.

SHOCK HAZARD:
The equipotential link and the grounding of the metal parts of the bed depend on the correct installation of the earth conductor and grounding spring blades. Personal injury could result if the installation is not correct and/or if the earth continuity is compromised.

3. Check that the earth continuity of the accessible metal parts is correct (see “Earth resistance” on page 6-7 in the Preventive Maintenance Schedule).

SHOCK HAZARD:
An abnormally high leakage current is symptomatic of a degradation within the AC power cable and the PSU. Personal injury could result if the value of the leakage current is above 500 microamperes.

4. Check that the leakage current of the bed is correct (see “Leakage current” on page 6-8 in the Preventive Maintenance Schedule).

5. Perform the “Function Checks” on page 2-6.

4.6 Battery Backup and Emergency Trendelenburg Function

Identification: The batteries are located in the PSU (see figure 3-1 on page 3-3)

Time required: 10 min

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 13 mm ratchet wrench

Removal

1. Apply the brakes, raise the sleep surface to the high position, and the HS to the high position. Raise the siderails to the high position and remove the headboard.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

2. Lock out all the functions. Unplug the power connector from the power outlet. Ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

3. Using the 13 mm ratchet wrench, loosen and remove the two screws (A) securing the cover (B) to the PSU, recover the two screws and remove the cover (B) by unclipping it (see figure 4-9 on page 4-19).

4. Remove the battery backup (F) or emergency trendelenburg function (G) battery from their housing in the PSU (see figure 4-10 on page 4-19).

5. If the battery backup is being replaced, note the connection of the wires on the batteries, red wire (H) on the outer and red terminals, black wire (I) on outer terminal, and the short wire connecting the two central terminals, then disconnect them and lift away the batteries (see figure 4-11 on page 4-23).

6. If the emergency trendelenburg battery is being replaced, each battery has a specific cable with special connector, disconnect the connectors of both batteries and lift them away.

Figure 4-11. Battery Backup Connections

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Replacement

1. Perform the removal in reverse order, while ensuring that the correct polarities are used when connecting new batteries.

NOTE:
To prevent connection errors, the connections of the battery backup and the emergency trendelenburg function battery are different.

NOTE:
When connecting the batteries, the red wire must be connected last. A spark is produced when it is connected, but is not dangerous for the power supply P.C. board or the technical personnel.

CAUTION:
The polarities must be respected when installing the elements of the battery backup. Disregarding this caution will permanently damage the power supply P.C. board of the bed.

2. Disconnect the bed from the power outlet, then perform the following tests according to the batteries fitted on the bed:
   - Battery backup after full charge: minimum of 3 HL, HS, TS and FS (LI159Ax) full raise and lower cycles.
   - Emergency trendelenburg battery: minimum of 3 full trendelenburg cycles from the full reverse trendelenburg poistion and the HS in the high position.

NOTE:
The technician may lie on the bed during these tests.

3. The batteries should be fully recharged at the end of the test or if the low batery signal is heard during the tests.

4. Perform the “Function Checks” on page 2-6.

4.7 Lateral Caregiver Unit

Identification: (see figure 3-1 on page 3-3)

Time required: 15 min

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 13 mm ratchet wrench

Removal

1. Identify the functions of the LCU to be replaced (emergency trendelenburg present or not) to ensure that the replacement will allow the same functions.

2. Apply the brakes, raise the sleep surface to the high position, the sleep surface to horizontal, then raise the siderails and the HS to the high position. Remove the headboard, then remove the hard surfaces of the SS and the TS.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

3. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

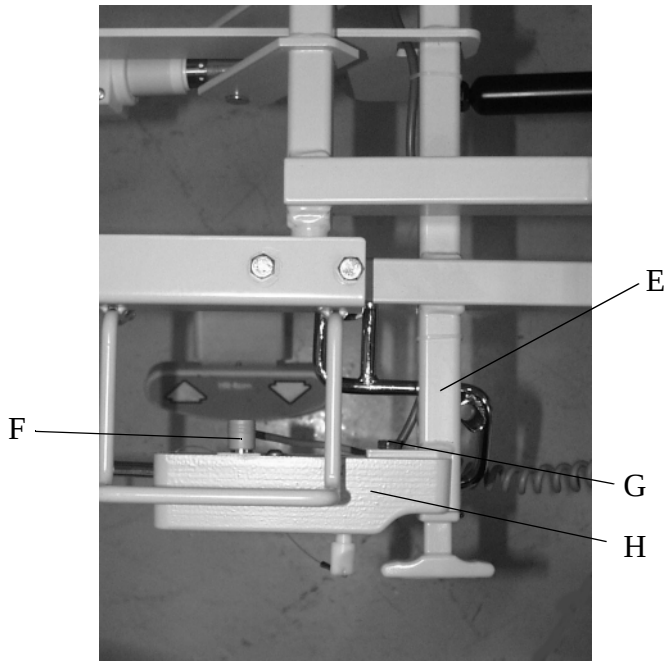
4. Using the 13 mm ratchet wrench, loosen and remove the two screws (A) securing the cover (B) to the PSU, recover the two screws and remove the cover (B) by unclipping it (see figure 4-9 on page 4-19).

5. Remove the cable cover (C).

6. On the main board (D) of the PSU, disconnect the connector #1a or #1b from the LCU cable to be replaced (see table 4-1 on page 4-20) and remove the cable from the central rail of the bed frame (see figure 4-10 on page 4-19).

7. Open the cable track located under the crossbar (E) of the bed frame and free the cable from the LCU (see figure 4-12 on page 4-26).

Figure 4-12. Installing the Lateral Caregiver Unit



8. Disconnect the connector (F) of the control pendant or control panel on a flexible arm if this is connected to the LCU that is to be replaced (see figure 4-12 on page 4-26).

9. Using the 13 mm ratchet wrench, remove the screw (G) securing the LCU (H) to the bed frame and remove it from the bed.

Replacement

1. Identify the functions of the LCU to be replaced (emergency trendelenburg present or not) to ensure that the replacement will allow the same functions.

2. Perform the removal procedure in reverse order.

3. Perform the “Function Checks” on page 2-6.

4.8 Head Section Actuator

Identification: (see figure 3-1 on page 3-3)

For clarity, two separate procedures are used for the removal of the HS actuator and its CPR release cable. However, they are part of the same kit (one reference available).

Time required: Time required: 30 min

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 10 mm combination spanners—2 required
13 mm ratchet wrench

Removal

1. Apply the brakes, raise the sleep surface to the high position, the HS in high position, the HS, the TS, and the FS to horizontal. Fold the foot siderails then lower the siderails. Remove the headboard.

NOTE:
If the HS actuator is defective, use the CPR control to raise the HS.

2. Remove the hard surfaces of the SS and the TS (refer to procedure 4.1).

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

3. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

4. Using the 13 mm ratchet wrench loosen and remove the two screws (A) securing the cover (B) on the PSU, recover the two screws and remove the cover (B) by unclipping it (see figure 4-9 on page 4-19).

5. On the main board (D) of the PSU, disconnect the connector #3 of the HS actuator (see table 4-1 on page 4-20).

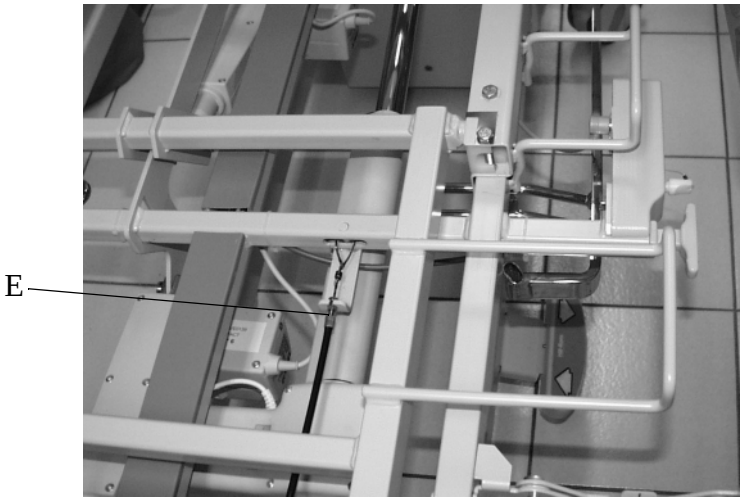
6. Lift the cable cover (C) of the central rail and remove the cable from the HS actuator.

7. Operate the CPR control (see “CPR Emergency Release” on page 1-17) and lower the HS to horizontal.

8. With the two 10 mm combination spanners, loosen the adjuster (E) (see figure 4-13 on page 4-28).

NOTE:
Adjusting the CPR cable involves compensating the play at the level of the CPR handle and the HS actuator by the adjuster, without creating any previous tension of the cable.

Figure 4-13. CPR Cable Stop



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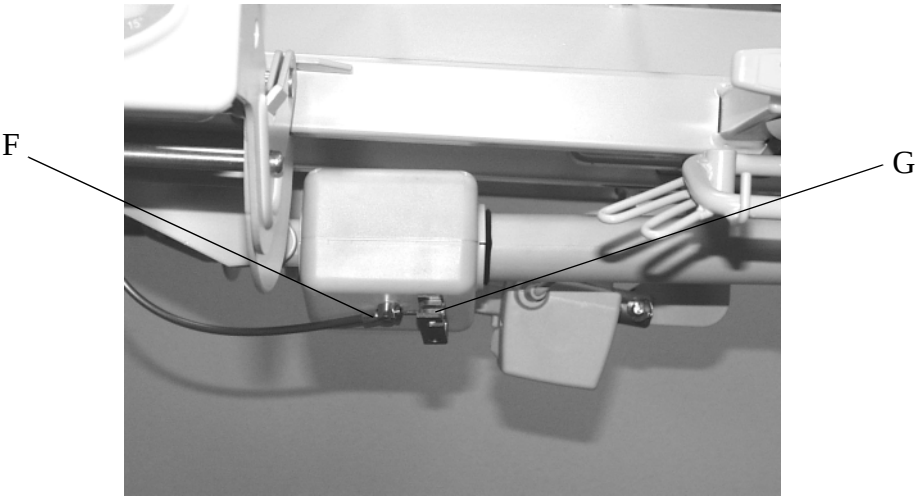
9. Pull on the CPR cable sleeving to separate the adjuster (E) from its support.

10. Using the two 10 mm combination spanners, loosen the nut of the sleeving stop (F) and free the CPR cable from its guide on the actuator (see figure 4-14 on page 4-28).

Figure 4-14. CPR Control on HS Actuator



1680_429

11. Remove the cable and its pivoting attachment from the release cam (G).

NOTE:
The release cam (G) has a slot enabling the cable to pass. This slot must always point toward the articulation (centre of the motor) when installing so as to prevent it from retracting when in use.

12. Remove the Truarc®[1] circlips from the pin at the end of the HS actuator rod and remove the pin while supporting the actuator.

13. Remove the Truarc® circlips from the pin supporting the actuator body, and remove the pin while supporting the actuator and remove the actuator from the bed.

Replacement

1. Perform the removal procedure in reverse order.

CAUTION:
Ensure that the elastic found on the new actuators is not wound around the actuator body before removing it (cut). If necessary, turn the actuator end rod in the appropriate direction to unwind this elastic. It is used to indicate the correct position of the switches and internal end of travels of the actuator. The incorrect position of these elements may damage the actuator or the structure of the bed.

2. Perform the “Function Checks” on page 2-6.

1. Truarc® is a registered trademark of Waldes Truarc, Inc.

4.9 Head Section Release Cable

Identification: (see figure 3-1 on page 3-3)

NOTE:
The HS release cable is a Y-cable common to the two CPR handles. The two uncovered branches are, however, of different lengths.

Time required: Time required: 15 min

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 10 mm combination spanners—2 required
Small screwdriver

Removal

1. Perform steps 8 to 11 of the HS actuator replacement (refer to procedure 4.8).
2. It is important to note that each side of the CPR cable (H) runs behind the pivot point (I) of the bed frame crossbar (see figure 4-15 on page 4-30).
3. Comment on the cable position:
   - The end of the cable arriving at the pivot point (I) passes behind this point then continues to the left.
   - The end that arrives at the left of the pivot point (I) also passes behind this point, then continues to the right.

Figure 4-15. CPR Handles and Cable

1680_439

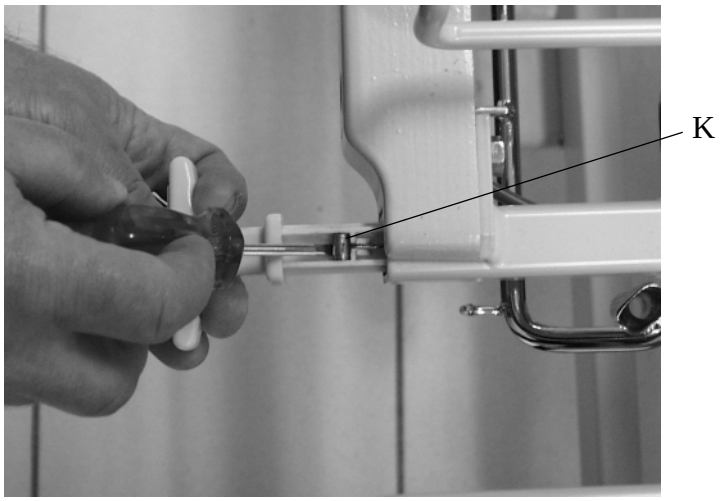
4. With the two 10 mm combination spanners, loosen the adjuster (E).

5. Pull on the CPR cable sleeving to separate the adjuster (E) from its support.

6. Using the two 10 mm combination spanners, loosen the nut of the sleeving stop (F) and free the CPR cable from its guide on the actuator (see figure 4-14 on page 4-28).

7. With the adjuster (E) removed from its support, pull on one of the CPR handles and remove the end of the cable from the cable stop (K) on the CPR handle with the small screwdriver, then repeat on the other CPR handle (see figure 4-16 on page 4-31).

Figure 4-16. Fitting the CPR Cable



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8. Remove the two ends of the CPR cable from the bed frame (J) while noting their position with respect to the pivot point (I) (see figure 4-15 on page 4-30).

Replacement

1. Perform the removal procedure in reverse order.

2. Return to the following adjustment procedure in the event of incorrect operation.

3. Perform the “Function Checks” on page 2-6.

Adjustment

1. Using the two 10 mm combination spanners, loosen the adjuster nuts (E).

2. Apply a gentle pull on the cable at the adjuster (E) to compensate for the play at the level of the CPR handles and the HS actuator. Manually tighten the adjuster nuts (E).

NOTE:
There should not be any tension on the cable, merely compensation for the play at the level of the CPR handles and the HS actuator.

3. Lock the nuts using the two 10 mm combination spanners.

4. Gently pull on each handle to ensure that there is no play after the nuts have been tightened.

4.10 Thigh Section Actuator

Identification: (see figure 3-1 on page 3-3)

Time required: 15 min

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 13 mm ratchet wrench

Removal

1. Apply the brakes, raise the sleep surface to the high position, the HS in the high position, and the TS (if possible) and the FS to horizontal. Fold the foot siderails then lower the siderails. Remove the headboard.

2. Remove the hard surfaces of the SS and the TS (refer to procedure 4.1).

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

3. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

4. Using the 13 mm ratchet wrench, loosen and remove the two screws (A) securing the cover (B) on the PSU, recover the two screws and remove the cover (B) by unclipping it (see figure 4-9 on page 4-19).

5. On the main board (D) of the PSU disconnect the connector #5 of the TS actuator (see table 4-1 on page 4-20) (see figure 4-10 on page 4-19).

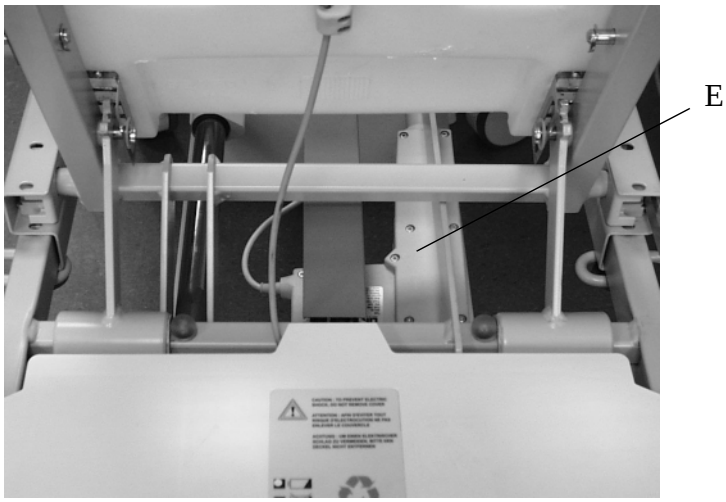
6. Lift the cable cover (C) on the central rail of the sleep surface and remove the cable of the TS actuator (see figure 4-9 on page 4-19).

7. Remove the Truarc®[1] circlips from the pin at the end of the TS actuator rod (E) and remove the pin while supporting the actuator (see figure 4-17 on page 4-34).

NOTE:
Support the actuator, then lay the TS flat if you could not lower this section to the horizontal position initially.

1. Truarc® is a registered trademark of Waldes Truarc, Inc.

Figure 4-17. Thigh Section actuator



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8. Remove the Truarc®[1] circlips from the pin supporting the TS actuator, and remove the pin while supporting the actuator.

Replacement

1. Perform the removal procedure in reverse order.

CAUTION:
Ensure that the elastic found on the new actuators is not wound around the actuator body before removing it (cut). If necessary, turn the actuator end rod in the appropriate direction to unwind this elastic. Indeed, it is used to indicate the correct position of the switches and internal end of travels of the actuator. The incorrect position of these elements may damage the actuator or the structure of the bed.

2. Perform the “Function Checks” on page 2-6.

1. Truarc® is a registered trademark of Waldes Truarc, Inc.

4.11 Foot Section Actuator Replacement (LI159Ax only)

Identification: (see figure 3-1 on page 3-3)

Time required: 20 min

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 13 mm ratchet wrench

Removal

1. Apply the brakes, raise the sleep surface to the high position, the HS in the high position, and the TS in the intermediate position. Fold the foot siderails, then lower the siderails.

2. Remove the head and footboards then the hard surfaces of the SS, the TS, and the FS (refer to procedure 4.1). Remove any of accessories that may be fitted to the FS.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

3. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

4. Using the 13 mm ratchet wrench, loosen and remove the two screws (A) securing the cover (B) on the PSU, recover the two screws and remove the cover (B) by unclipping it (see figure 4-9 on page 4-19).

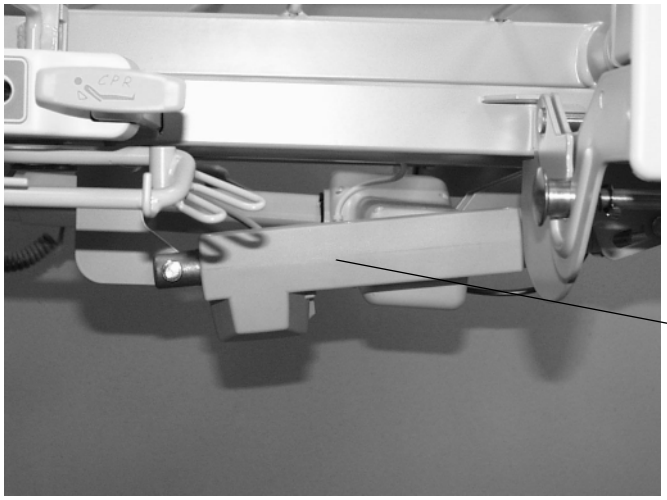
5. On the main board (D) of the PSU, disconnect the connector “con2” of the FS actuator (see table 4-1 on page 4-20) (see figure 4-10 on page 4-19).

6. Lift the cable cover (C) on the central rail of the sleep surface and remove the cable of the FS actuator (see figure 4-9 on page 4-19).

7. Support the FS and remove the Truarc®[1] circlips from the pin at the end of the FS actuator (E) (see figure 4-18 on page 4-36).

1. Truarc® is a registered trademark of Waldes Truarc, Inc.

Figure 4-18. Foot Section Actuator



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8. Remove the pin while supporting the FS and the FS actuator.

9. Remove the Truarc®[1] circlips from the pin supporting the FS actuator body and remove the pin from the actuator.

10. Lay the FS on the intermediate frame or on a support that will maintain it in a horizontal position.

Replacement

1. Perform the removal procedure in the reverse order.

CAUTION:
Ensure that the elastic found on the new actuators is not wound around the actuator body before removing it (cut). If necessary, turn the actuator end rod in the appropriate direction to unwind this elastic. Indeed, it is used to indicate the correct position of the switches and internal end of travels of the actuator. The incorrect position of these elements may damage the actuator or the structure of the bed.

2. Perform the “Function Checks” on page 2-6.

1. Truarc® is a registered trademark of Waldes Truarc, Inc.

4.12 Head Hilow Column

Identification: (see figure 3-1 on page 3-3)

Time required: 40 min

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 13 mm ratchet wrench with extension
Elevation tool (P/N AG0052)

Removal

1. Raise the sleep surface to the high position (at least the FS if H-Col cannot be used), the casters in line with the bed and apply the brakes.

2. Lower the TS and the FS to the low position and raise the HS to the high position. Raise and lock the siderails in high position and remove the head and footboards.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

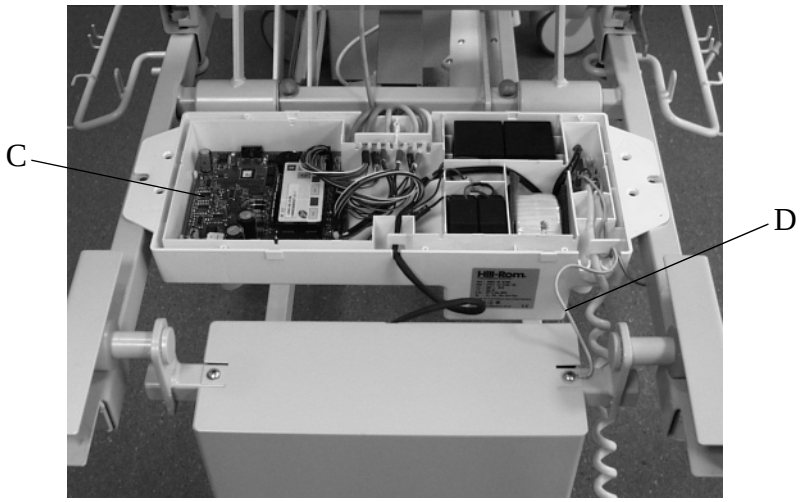
3. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

4. Using the 13 mm ratchet wrench, loosen and remove the two screws (A) securing the cover (B) on the PSU, recover the two screws and remove the cover (B) by unclipping it (see figure 4-9 on page 4-19).

5. Free the head end frame cover. Note that it is secured by clips at each end.

6. Note the passage of the H-Col cable, then on the main board (D) of the PSU disconnect the connector #6 of the H-Col (see table 4-1 on page 4-20) and free the cable from the H-Col (see figure 4-10 on page 4-19).

Figure 4-19. Head HL Column Supply



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7. Disconnect the earthing conductor (D) of the H-Col by unclipping it from the AC input board (see figure 4-19 on page 4-38).

8. Perform the following if the bed is imobilised in the low position:

   a. Plug the bed into an appropriate power source, and lockout all the functions except the HL function.

   b. Operate the HL raise using the control pendant to bring the F-Col to high position.

NOTE:
When a faulty HL column is disconnected, the other column will still function.

   c. Lock out the HL function.

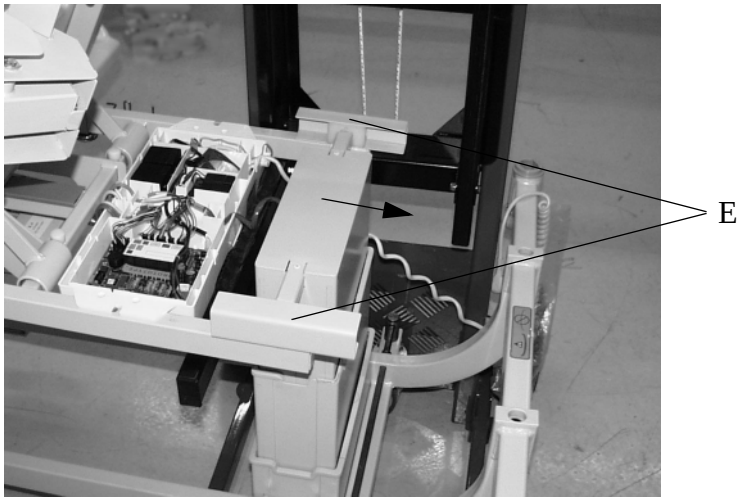
SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

   d. Disconnect the bed from the electrical power supply. If the bed has a battery, ensure that no LED is lit up on the control pendant. If this is not the case, wait for around one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

CAUGHT HAZARD:
The elevation tool must be used to remove the column in safety. Use the elevation tool, otherwise personal injury could occur.

9. Position the elevation tool at the level of the guide arms (E) and adjust the arms to the height corresponding to the bed frame. Lift the arms situated at the head end of the bed (see figure 4-20 on page 4-39).

Figure 4-20. Upper Installation of Head HL Column



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10. Remove the two covers (F) situated at the base of the column (see figure 4-22 on page 4-44).

11. Using the 13 mm ratchet wrench, loosen and remove the 4 screws securing the base of the column to the frame.

12. Ensure that the bed frame is safely secured at its height, then slide the column towards the head end of the bed to remove it from its guide rails (E) on the bed frame , then remove it from the bed. Note that the power supply cable of the column comes out from the side of the PSU (see figure 4-20 on page 4-39).

13. If the bed is imobilised in the low position,:gradually bring the head end of the bed frame with the H-Col to high position using the elevation tool so as to slide the H-Col from its guide rails (E).

Replacement

SHOCK HAZARD:
The equipotential link and the grounding of the metal parts of the bed depend on the correct installation of the earth conductor and grounding spring blades. Personal injury could result if the installation is not correct and/or if the earth continuity is compromised.

1. Remove the two covers (F) situated at the base of the column (see figure 4-22 on page 4-44).

2. Position the new HL column of the frame without mounting it and connecting its connector to #6 of the main board (C) of the PSU (see figure 4-10 on page 4-19) (see table 4-1 on page 4-20).

3. Plug the bed into an appropriate power source, and lockout all the functions except for the HL function.

4. Operate the HL raise by using the control pendant in order to raise the upper section of the column to the level of the bed frame.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

5. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for approximately one minute until the battery mode is deactivated.

6. Perform the removal procedure in reverse order.

NOTE:
Leave as much play as possible at the level of the H-Col between this column and the PSU.

7. Refit the two covers (F) located at the base of the column (see figure 4-22 on page 4-44).

8. Operate the trendelenburg function of the bed to ensure that there is no tension on the power supply cable of the column during operation. If necessary, adjust the play of the cable with respect to the PSU.

SHOCK HAZARD:
The equipotential link and the grounding of the metal parts of the bed depend on the correct installation of the earth conductor and grounding spring blades. Personal injury could result if the installation is not correct and/or if the earth continuity is compromised.

9. Check that the earth continuity of the accessible metal parts is correct (see "Earth resistance" on page 6-7 in the Preventive Maintenance Schedule).

10. Perform the "Function Checks" on page 2-6.

4.13 Foot Hilow Column

Identification: (see figure 3-1 on page 3-3)

Time required: 40 min

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 13 mm ratchet wrench with extension
Elevation tool (P/N AG0052)

Removal

1. Raise the sleep surface to the high position (at least the head end if F-Col cannot be used), the casters in line with the bed and apply the brakes.

2. Raise the TS and the FS to the high position and lower the HS to horizontal. Raise and lock the siderails, foot siderails in the folded position and remove the footboard. Lower the foot siderail supports.

3. Remove the hard surfaces of the TS and FS (see "Bed Frame Hard Surface Replacement" on page 4-5) then remove the linen holder if fitted to the bed.

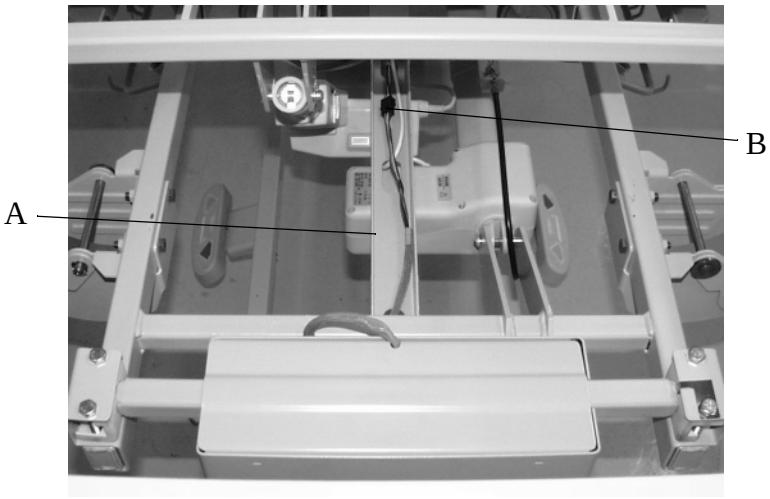
SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

4. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

5. Free the foot frame cover (A). Note that it is secured by clips at each end (see figure 4-25 on page 4-51).

6. Remove the cable cover on the central rail (A) of the sleep surface at the foot end of the bed, and disconnect the cable from the F-Col at the level of the connector (B) (see figure 4-21 on page 4-43).

Figure 4-21. Foot Hilow Column Connection



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7. Perform the following if the bed is imobilised in the low position:
    a. Plug the bed into an appropriate power source, and lockout all the functions except the HL function.
    b. Operate the HL raise using the control pendant to bring the H-Col to high position.

NOTE:
When a faulty HL column is disconnected, the other column will still function.

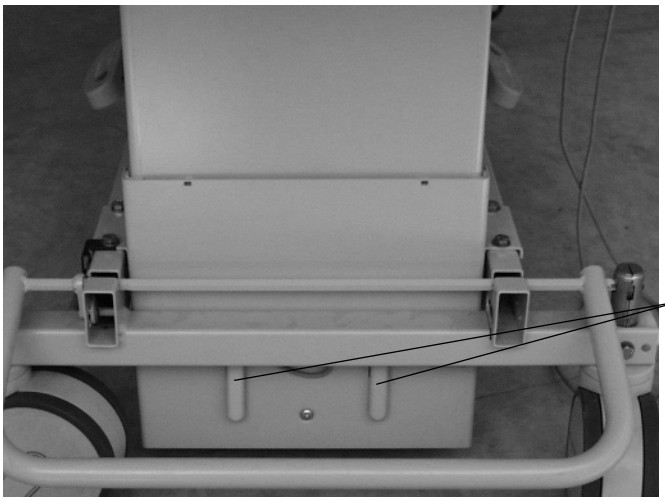
    c. Lock out the HL function.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

    d. Disconnect the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit up on the control pendant. If this is not the case, wait for around one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

8. Remove the two covers (F) of the cable(s) exiting from the base of the Head column (1 cable for the BM, plus 2 HL pedal cables—optional), and disconnect the relevant cable(s)) (see figure 4-22 on page 4-44).

Figure 4-22. Foot Hilow Column Base



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9. Open the cable tracks situated under the foot crossbar of the frame and free the cables.

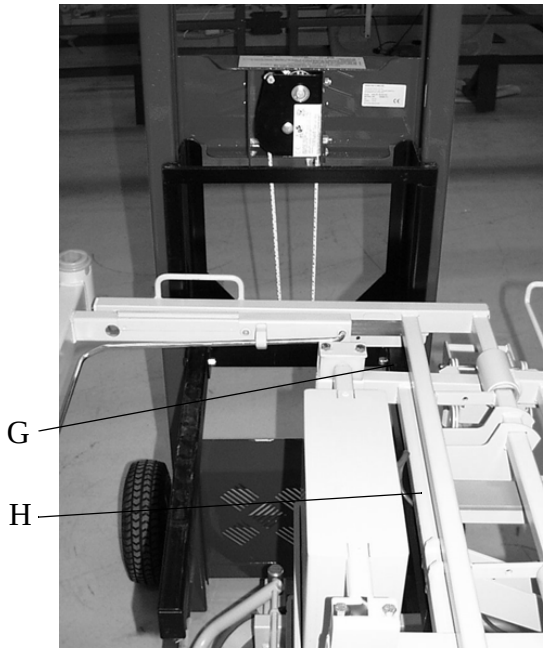
CAUGHT HAZARD:
The elevation tool must be used to remove the column in safety. Use the elevation tool, otherwise personal injury could occur.

10. Position the elevation tool and adjust its height so that the arm (G) supports the foot crossbar (H) of the bed frame (see figure 4-23 on page 4-45).

CAUGHT HAZARD:
The bed frame must be secured, lengthways, to prevent it coming away from the rail at the level of the H-Col. Disregarding this precaution may cause injuries.

11. Ensure that the frame is correctly locked lengthways by the arm (G) of the elevation tool, which secures it at the level of the crossbar through its U-shape.

Figure 4-23. Foot Section Support



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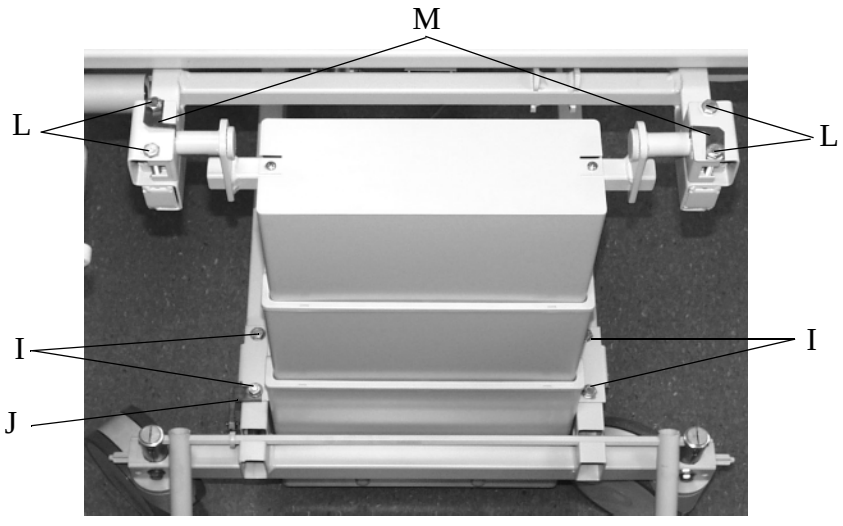
12. Using the 13 mm ratchet wrench, loosen and remove the 4 screws (I) securing the base of the HL column (see figure 4-24 on page 4-45).

NOTE:
For example, the photo shows an HL column with the 45 to 85 cm option.

Figure 4-24. Foot Hilow Column



1680_408

13. Recover the BM assembly (J) (optional).

14. Using the 13 mm ratchet wrench, loosen and remove the four screws (L) on each side of the column and recover the grounding spring (M).

15. Slightly raise the bed frame foot section using the elevation tool, tilt the column outwards then slide its upper section so as to remove it from the guide rails. Remove the column from the bed.

Replacement

SHOCK HAZARD:
The equipotential link and the grounding of the metal parts of the bed depend on the correct installation of the earth conductor and grounding spring blades. Personal injury could result if the installation is not correct and/or if the earth continuity is compromised.

1. Remove the two covers (F) situated at the base of the new column (see figure 4-22 on page 4-44).

2. Free the intermediate power supply cable from the column of the central rail (A), through the lower openings of this element so as to bring the connector (B) to one of the sides of the bed (see figure 4-21 on page 4-43).

3. Position the new HL column of the frame on the same side without mounting it and connect its connector to the intermediate connector (B).

4. Plug the bed into the power outlet and lock out all the functions except for the HL function

5. Operate the HL raise function with the control pendant so as to bring the upper section of the column to the level of the bed frame.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

6. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated.

7. Perform the removal procedure in reverse order.

NOTE:
Leave as much play as possible at the level of the HL column cable between this cable and the PSU.

8. Refit the two covers (F) situated at the base of the column (see figure 4-22 on page 4-44).

9. Operate the trendelenburg function of the bed to ensure that there is no tension on the power supply cable of the column during operation. If necessary, adjust the play of the cable with respect to the PSU.

SHOCK HAZARD:
The equipotential link and the grounding of the metal parts of the bed depend on the correct installation of the earth conductor and grounding spring blades. Personal injury could result if the installation is not correct and/or if the earth continuity is compromised.

10. Check that the earth continuity of the accessible metal parts is correct (see "Earth resistance" on page 6-7 in the Preventive Maintenance Schedule).

11. Perform the "Function Checks" on page 2-6.

4.14 Hilow Pedal

Identification: (see figure 3-1 on page 3-3)

Time required: 15 min

Number of people: 1

Possibility of intervening with patient on the bed: Yes

Tools required: Small screwdriver
13 mm ratchet wrench

Removal

NOTE:
The two pedals are independent. The following procedure applies to both pedals.

1. Apply the brakes. Set the siderails to high, deployed, the TS and the FS to horizontal position and the sleep surface to the high position.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

2. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

3. Free the foot frame cover (A). Note that it is secured by clips at each end (see figure 4-25 on page 4-51).

4. Remove the cable cover (F) situated on the column next to the pedal to be removed (see figure 4-22 on page 4-44).

5. Using the small screwdriver, open the two cable tracks situated under the frame between the pedal to be removed and the F-Col.

6. Remove the pedal cable from the cable tracks as well as the cable support situated at the level of the foot crossbars of the frame.

7. Disconnect the cable from the pedal at the base of the F-Col.

8. Using the 13 mm ratchet wrench, partly loosen the bolt securing the pedal to the frame, then slide the pedal to remove it from the frame.

Replacement

1. Perform the removal procedure in reverse order.
2. Perform the “Function Checks” on page 2-6.

4.15 Replacement of Microswitch Assembly for Bed Braking Detection

Identification: (see figure 3-1 on page 3-3)

Time required: 15 min

Number of people: 1

Possibility of intervening with patient on the bed: Yes

Tools required: Small screwdriver
13 mm ratchet wrench

Removal

1. Apply the brakes. Raise and lock the siderails and deploy the foot siderails, lower the TS and the FS to horizontal and the sleep surface to the high position.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

2. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

3. Free the foot frame cover(A). Note that it is secured by clips at each end (see figure 4-25 on page 4-51).

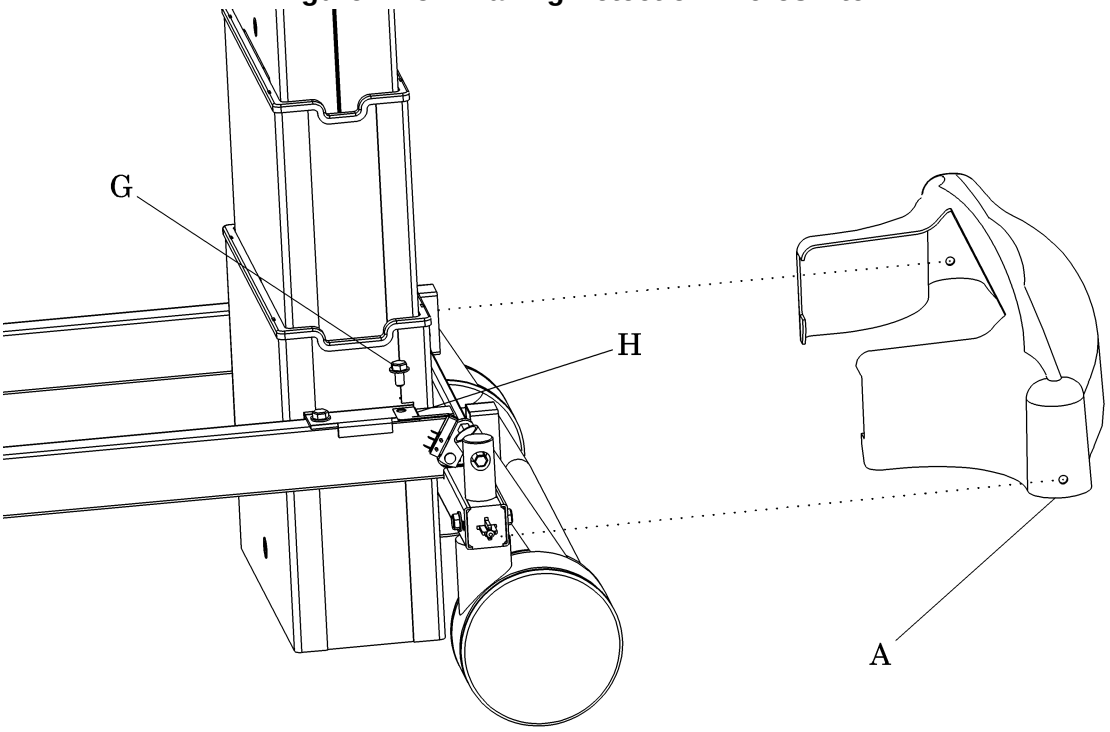
4. Remove the cable cover (F) situated on the F-Col next to the BM to be removed and disconnect the cable from the BM (see figure 4-22 on page 4-44).

5. Open the cable track located under the foot crossbar of the frame and remove the cable from the BM.

6. Using the 13 mm ratchet wrench, loosen and remove the screw (G) securing the BM support (H) to the frame.

NOTE:
The two cables are connected to the external terminals of the BM (terminals 1 and 2: NC).

Figure 4-25. Braking Detection Microswitch



Replacement

1. Perform the removal procedure in reverse order.
2. Perform the “Function Checks” on page 2-6.

4.16 Single Brake Bar

Identification: (see figure 3-1 on page 3-3)

Time required: 40 min

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 13 mm ratchet wrench
10 mm Allen™[1] key
6 mm Allen™ key—5th wheel steering system only
8 mm pin punch
Screwdriver
Soft faced hammer
Elevation tool (P/N AG0052)

NOTE:
Removing the brake and steer system means breaking, and therefore replaceing, the two bushes that linking the braking bar, link bar and hexagonal brake bar at the head end of the bed.

NOTE:
The single brake bar is part of a kit that also contains the head end hexagonal bar and the plastic articulation bushes.

Removal

1. Apply the brakes, set the sleep surface to mid-height and the TS and the FS to the horizontal position. Raise and lock the siderails in high, with the foot siderails folded.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

2. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

3. Free the head and foot frame cover (A). Note that it is secured by clips at each end (see figure 4-25 on page 4-51).

1. Allen™ is a trademark of Industrial Fasteners, Inc.

CAUTION:
If the sleep surface cannot be raised to mid-height for whatever reason, the arms of the elevation tool must not be positioned at the level of the actuators. Disregarding this caution may cause the head section and foot section actuators to malfunction.

WARNING:
Never lift the entire bed with the elevation tool. Its maximum load is 150kg. Disregarding this warning may cause the elevation mechanism to malfunction and could cause injury.

4. Position the arms of the elevation tool under the right hand side of the frame.

Figure 4-26. Removal of the Braking Bar

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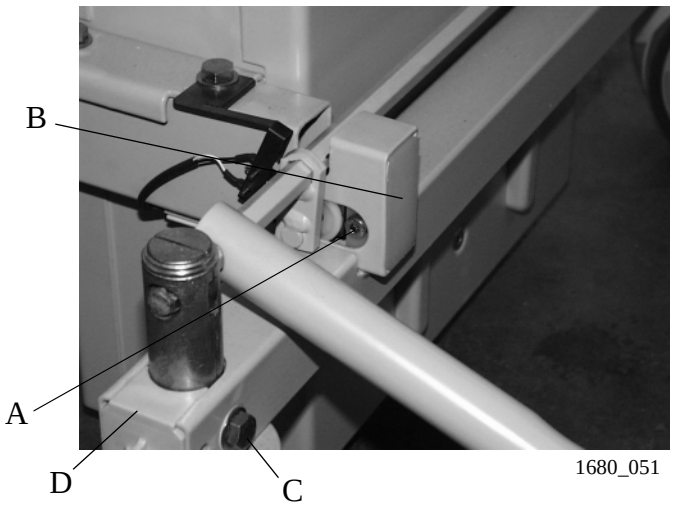
5. For beds fitted with a 5th wheel system, use the 6 mm Allen™[1] key to remove the screw (A) securing the braking bar stop (B) (see figure 4-27 on page 4-54).

1. Allen™ is a trademark of Industrial Fasteners, Inc.

Figure 4-27. Braking Bar Stop

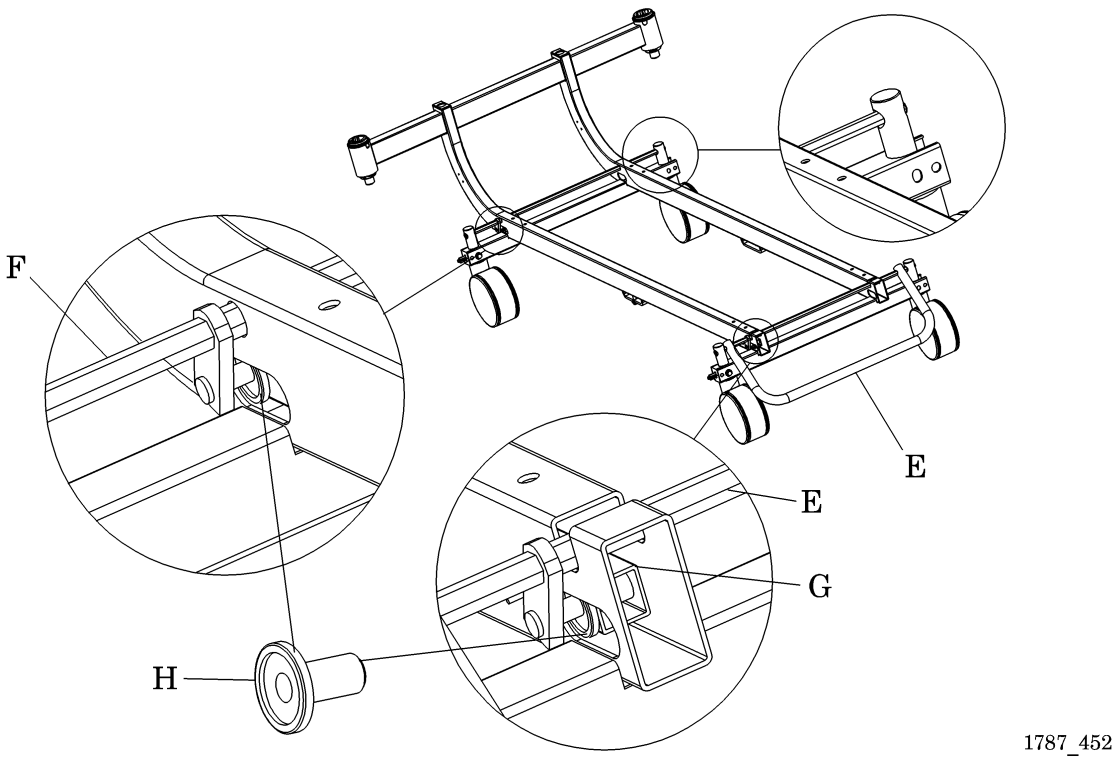


6. Adjust the elevation tool so as to lift the frame by a few centimetres.

7. Using the 13 mm ratchet wrench, loosen the 4 screws (C) securing the head and foot end casters on the right hand side of the frame.

8. Set the single brake bar (E) to neutral position (horizontal) (see figure 4-28 on page 4-54).

Figure 4-28. Braking System



9. Remove the caster plus support assembly (D) by using the soft faced hammer (see figure 4-27 on page 4-54).

NOTE:
Do not rotate the casters in their sockets. This is to retain the adjustment.

10. Using the soft faced hammer and the 8 mm pin punch (head end), punch out the brake and steer bar (E) and the head end hexagonal bar (F) from the right hand end of the bed (viewed by a patient) (see figure 4-28 on page 4-54).

NOTE:
The plastic articulation bushes (H) will be damaged during this step, and must therefore be replaced.

11. Remove the link bar (G) of the right-hand longitudinal member of the chassis.

12. Using the soft faced hammer and the screwdriver, punch out the remaining pieces of the plastic articulation bushes (H) on the braking bar and the head hexagonal bar.

Replacement

1. Insert the new articulation bushes (H) into the openings of the link bar (G) .

2. Perform steps 9 to 11 of the removal procedure in reverse order.

3. Set the single brake bar to the brake position and check that the four casters brake.

4. If the casters are not braked, reset the single brake bar to neutral, remove the caster socket, rotate the caster rod by half a turn then refit the socket and the hexagonal bar.

5. Perform steps 1 to 7 of the removal procedure in reverse order.

6. Perform the “Function Checks” on page 2-6.

4.17 Caster, Brake and Steer Caster

Identification: (see figure 3-1 on page 3-3)

Time required: 15 min (without adjustment)

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 13 mm ratchet wrench
10 mm Allen™[1] key
Soft faced hammer
Medium screwdriver
Elevation tool (P/N AG0052)

NOTE:
When ordering a caster from a Hill-Rom spare parts service, remember that the bed may be fitted with the antistatic caster and/or foot steering caster options (see "Braking" on page 3-8).

When the bed is fitted with the 5th wheel steering system (see "Casters" on page 3-8), the braking bar is limited by a stop (B) and will have only two positions: neutral or brake activated. Take this information into account when fitting the casters (see figure 4-27 on page 4-54).

Removal

1. Apply the brakes, raise the sleep surface to mid-height, the HS, the TS and the FS to horizontal with the siderails raised and locked. remove the headboard.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

2. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button on the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

3. Free the head or foot frame cover (A) depending on the caster to be replaced. Note that it is secured by clips at each end (see figure 4-25 on page 4-51).

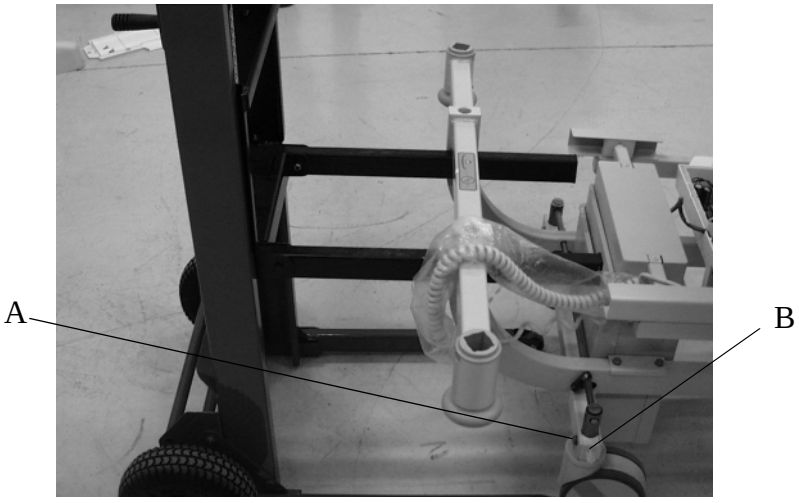
1. Allen™ is a trademark of Industrial Fasteners, Inc.

WARNING:
Never lift the entire bed with the elevation tool. Its maximum load is 150kg. Disregarding this warning may cause the elevation mechanism to malfunction and could cause injury.

CAUTION:
If the sleep surface cannot be raised to mid-height for whatever reason, the arms of the elevation tool must not be positioned at the level of the actuators. Disregarding this caution may cause the head section and foot section actuators to malfunction.

4. When replacing a caster at the head end of the bed, position the elevation tool under the head end crossbar of the bed (see figure 4-29 on page 4-57). Or when replacing a caster at the foot end of the bed, position the elevation tool under one of the sides of the frame (see figure 4-26 on page 4-53). Then adjust the elevation tool so as to raise the casters by a few centimetres.

Figure 4-29. Caster Installation



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5. Using the 13 mm ratchet wrench, loosen the 2 screws (A) securing the caster to be removed (see figure 4-29 on page 4-57).

6. Set the brake/steer bar to neutral position.

7. Remove the caster and its socket (B), possibly by using the soft faced hammer.

8. Remove the caster from its socket.

Replacement

1. Before installing the new caster, set the single brake bar to brake position, then steer position. Note the direction of rotation of the hexagonal bar when moving from one position to the other, then reset the bar to neutral.

2. Insert the new caster into the socket.

NOTE:
Each caster type has three positions as follows:

- Brake caster: two neutral positions and one brake position,
- Steer caster: one steer position, then neutral then brake.

CAUTION:
Ensure the caster is correctly positioned with respect to the movements of the hexagonal bar. Disregarding this caution may cause the brake and steer system to malfunction.

3. Position the socket in its location on the frame then, using the 10 mm Allen™[1] key, which you insert into the caster instead of the hexagonal bar, set the caster to brake position, then the steer position by rotating it in one direction or the other. Note the direction of operation with respect to the hexagonal bar of the bed and turn the body of the caster in the socket so that the operating movements coincide.

4. Remove the 10 mm Allen key, then fit the socket in its housing on the frame by inserting it into the upper opening of the caster in the hexagonal bar (head end of bed) or the brake bar (foot end).

5. Set the single brake bar to brake position and check that the new caster is braked.

6. If the caster is not braked, reset the bar to neutral, remove the socket from the caster, carry out a half-turn with the rod of the caster then remount the socket and hexagonal bar.

7. Perform steps 1 to 5 of the removal procedure of the caster in the reverse order.

8. Perform the “Function Checks” on page 2-6.

1. Allen™ is a trademark of Industrial Fasteners, Inc.

Adjustment: Single and Double Band Casters

Time required: 10 min per caster

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 13 mm ratchet wrench
10 mm Allen™[1] key
Soft faced hammer
Medium screwdriver
Loctite®[2] adhesive, 242
Elevation tool (P/N AG0052)

1. Perform steps 1 to 5 of the caster removal procedure.

NOTE:
The braking adjustment is defined in the caster brake position by the number of turns made on this caster from the first point of contact between the band and the braking system. The number of half-turns depends on the type of caster.

CAUTION:
When turning the double band caster, it is very important not to turn the caster until it is no longer braked, otherwise it may become impossible to adjust and damage may occur.

2. Turn the caster body counterclockwise (viewed from above) by successive half-turns until the caster is no longer braked.

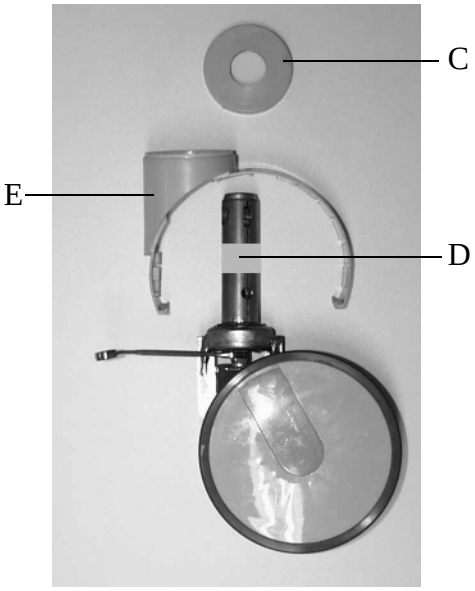
3. Turn the caster body clockwise (viewed from above) by successive half-turns until the first point of contact between the band and the braking system.

4. If the double band caster body has been loosened too much, it may be impossible to adjust it. In this case perform the following:
   a. Unclip and remove the upper cover (C) with the small screwdriver; place adhesive tape (D) around the shaft of the caster to block the two outer parts of the shaft (see figure 4-30 on page 4-60).
   b. Unclip the lower cover (E) of the caster with a screwdriver to be inserted at each side of the caster between the bands.
   c. Lift and remove the caster cover.
   d. Position the 10 mm combination spanner on the central shaft of the caster, which must always be braked, then turn the caster body clockwise (viewed from above), until the bands begin to be braked.

1. Allen™ is a trademark of Industrial Fasteners, Inc.
2. Loctite® is a registered trademark of Loctite Corporation.

e. Refit the caster covers.

Figure 4-30. Caster



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5. Depending on the caster type, adjust the caster body as follows:
   a. Non-antistatic single band caster: 4 half-turns clockwise (viewed from above).
   b. Antistatic single band caster: 3 half-turns clockwise (viewed from above).
   c. Antistatic and non-antistatic double band casters: 3 half-turns clockwise (viewed from above).
6. Fit the two securing screws of the caster and tighten them with the 13 mm ratchet wrench.

NOTE:
When adustments are complete, apply Loctite®[1] 242 adhesive to the two securing screws of the caster to ensure that they are properly locked.

7. Lower the elevation tool to place the bed on its casters.
8. Apply the brakes on the bed and check the braking efficiency by pushing the bed along a level floor with a force of 200 newtons. The bed must not move.

Steer Caster

There is no specific adjustment as regards the steering system of the casters, only the position of these casters on installation and braking are to be checked. Please refer to the replacement and adjustment sections of this procedure.

1. Loctite® is a registered trademark of Loctite Corporation, Inc.

4.18 5th Wheel Steering System

Identification: (see figure 3-1 on page 3-3)

Time required: 20 min

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 13 mm ratchet wrench
13 mm combination spanner
Elevation tool (P/N AG0052)

Removal

1. Apply the brakes, raise the sleep surface to mid-height, the HS to the high position, then the TS and the FS to horizontal. Raise and lock the siderails and remove the headboard.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

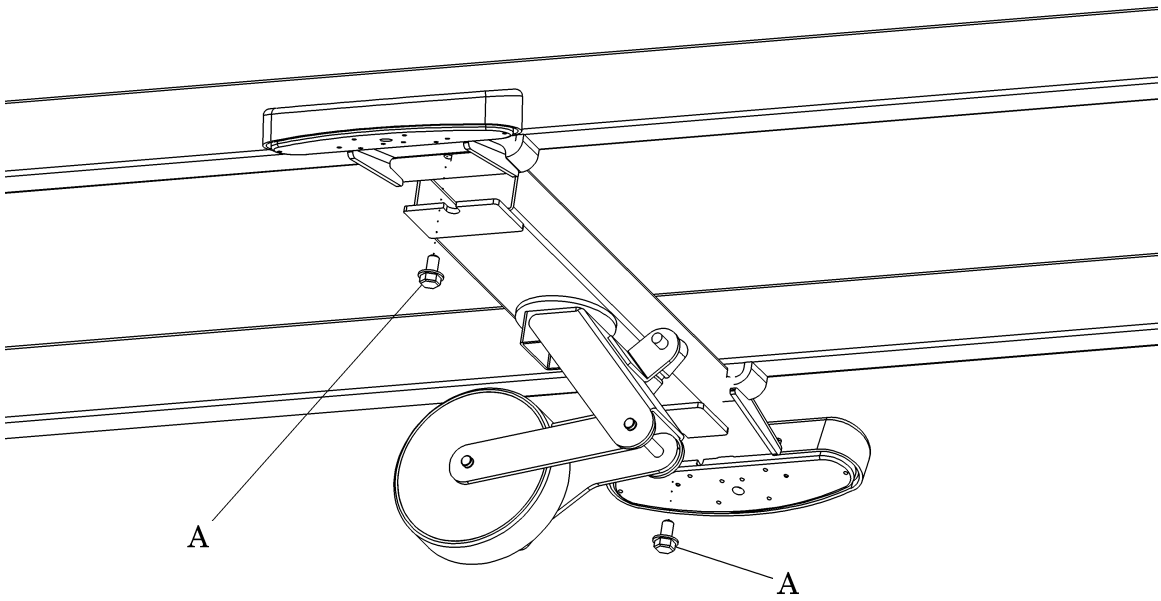
2. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

WARNING:
Never lift the entire bed with the elevation tool. Its maximum load is 150kg. Disregarding this warning may cause the elevation mechanism to malfunction and could cause injury.

3. Position the elevation tool under the head crossbar of the bed and adjust it so as to raise the casters by a few centimetres (see figure 4-29 on page 4-57).

4. Using the 13 mm combination spanner and 13 mm ratchet wrench, loosen and remove the two bolts (A) securing the 5th wheel steering system and remove the assembly. Recover the two bolts (A) (see figure 4-31 on page 4-62).

Figure 4-31. Installing the 5th Wheel Steering System



Replacement

1. Perform the removal procedure in reverse order.
2. Perform the “Function Checks” on page 2-6.

4.19 Head Section Gas Spring

Identification: (see figure 3-1 on page 3-3)

Time required: 10 min per gas spring

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 13 mm ratchet wrench
13 mm combination spanner

NOTE:
The bed has two HS gas springs. It is advisable to replace both of them, for reasons of force distribution.

Removal

1. Apply the brakes, raise the sleep surface to the high position, the TS and the FS to horizontal and the siderails lowered.

2. Raise the HS to the high position.

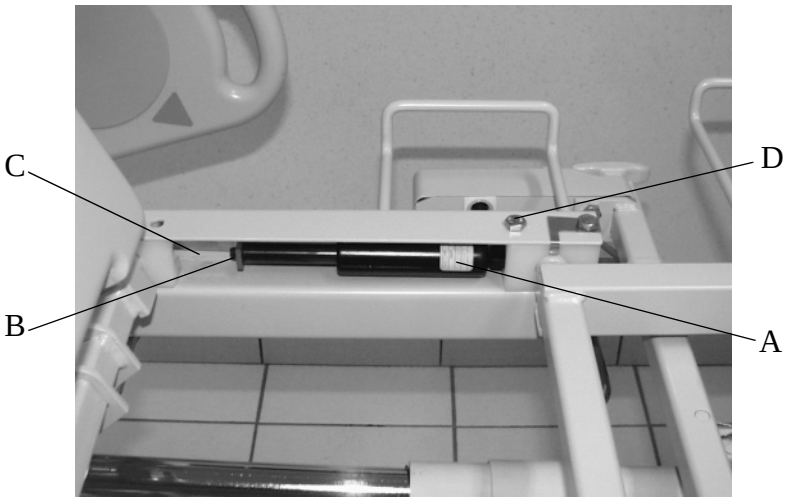
SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

3. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

4. Remove the hard surface of the seat section (refer to procedure 4.1).

5. On each gas spring, loosen the screw (B) securing the attachment plate (C) to the gas spring (A), by using the 13 mm combination spanner
(see figure 4-32 on page 4-64).

Figure 4-32. Head Section Gas Spring



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6. On each gas spring, remove the screw (D) securing the gas spring (A) by using the 13 mm ratchet wrench.

7. Manually unscrew each gas spring from the corresponding attachment plate (C) then remove them from their housing.

NOTE:
The gas spring is screwed flat against the attachment plate.

8. Remove the attachment plate (C).

NOTE:
The attachment plate is delivered with the gas spring.

Replacement

1. Perform the removal procedure in reverse order.

2. Perform the “Function Checks” on page 2-6.

4.20 Gas Spring Subassembly with Cable and Foot Section Sleeve (LI158Ax only)

Identification: (see figure 3-1 on page 3-3)

NOTE:
Only the full subassembly is available as a spare part. It is supplied ready assembled and adjusted.
Time required: 20 min

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: T25 Torx®[1] key

NOTE:
The bed has only one release lever, located on the right-hand side from the view point of a patient lying on the bed.

Removal

1. Apply the brakes, raise the sleep surface to the high position and lower the sleep surface sections to horizontal. Fold the foot siderails.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

2. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

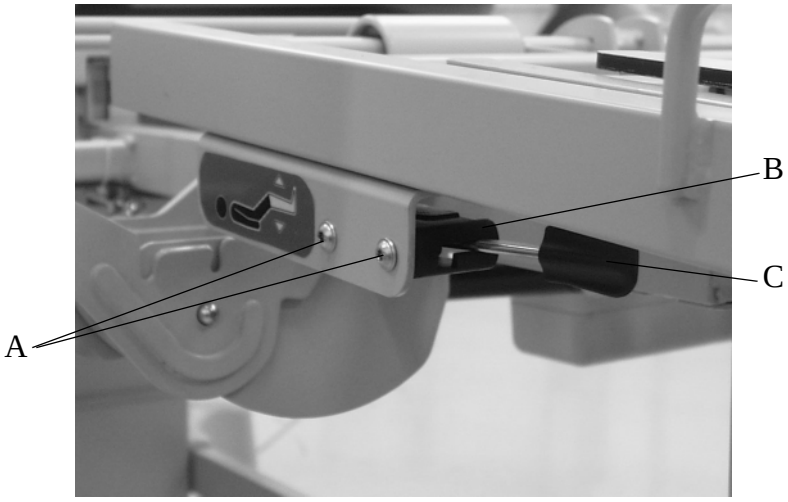
3. Remove the hard surfaces of the TS and the FS (see procedure 4.1 on page 4-5).

4. Position a support under the foot section of the bed frame so as to block it at the required height.

5. Using the T25 Torx® key, loosen and remove the two screws (A) securing the control lever subassembly (B) (see figure 4-33 on page 4-66).

1. Torx® is a registered trademark of Textron, Inc.

Figure 4-33. Assisted Foot Section Control



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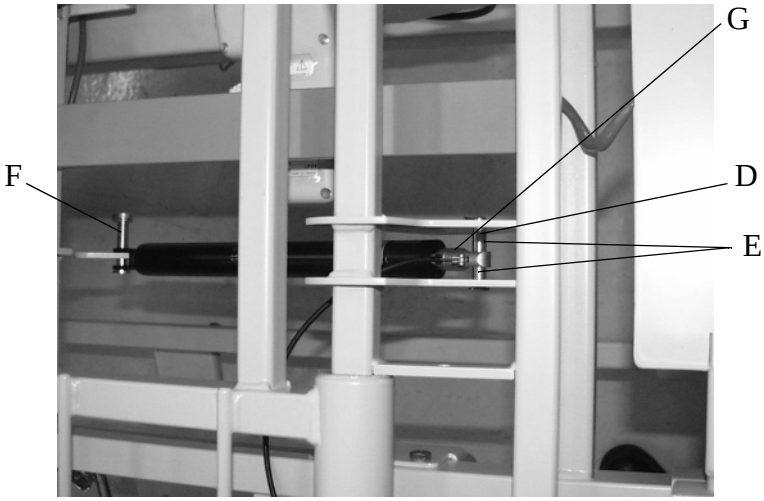
6. Remove the Truarc®[1] circlips from the pin (D) at the tip of the gas spring, then remove the pin while supporting the foot section of the bed frame and recovering the two spacers (E) (see figure 4-34 on page 4-66).

Figure 4-34. Assisted Foot Section Gas Spring



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7. Remove the Truarc® circlips from the pin (F) at the base of the gas spring, then remove the pin.

1. Truarc® is a registered trademark of Waldes Truarc, Inc.

Replacement

1. Perform the removal procedure in reverse order.

2. Perform the "Function Checks" on page 2-6.

Adjustment

Tools required: 6 mm combination spanner
8 mm combination spanner
17 mm combination spanner

NOTE:
The system is delivered fully assembled and adjusted. However, adjustment may be required during the life of the product if play is observed in the release handle (C). This adjustment must be made at the the control lever (B) (see figure 4-33 on page 4-66).

1. Check that the cable is positioned correctly at the level of the release head (G) of the gas spring (see figure 4-34 on page 4-66).

2. Using the 17 mm combination spanner, ensure that the locknut is correctly tightened on the release head (G) of the gas spring.

3. Using the 6 mm and 8 mm combination spanners, loosen the adjuster located at the level of the control lever subassembly (B) (see figure 4-33 on page 4-66).

4. Tighten the adjuster again to compensate for the play in the cable.

NOTE:
The cable must not have any prior tension.

5. Lock the adjuster of the control lever assembly (B) using the 6 mm and 8 mm combination spanners.

4.21 Head Siderail Including Elevation Arm Subassembly

Identification: (see figure 3-1 on page 3-3)

Time required: 20 min

Number of people: 1

Possibility of intervening with patient on the bed: Yes

Tools required: 13 mm ratchet wrench

Removal

1. Apply the brakes, raise the sleep surface to the high position, the sleep surface sections to horizontal.

2. Raise and lock the head siderails with the foot siderails folded.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

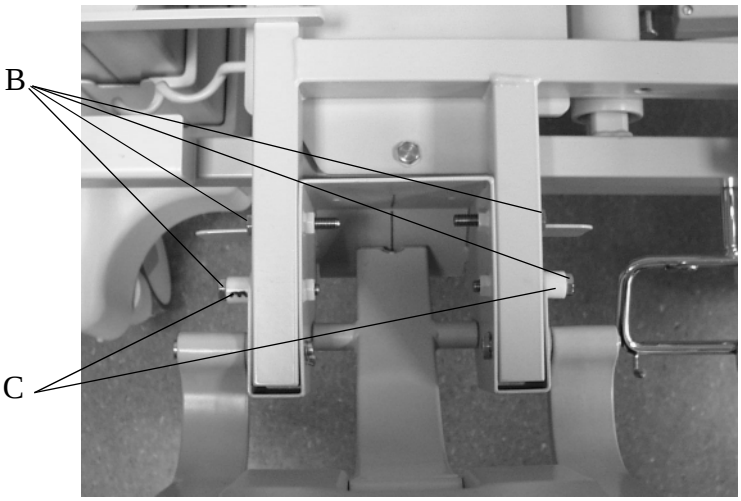
3. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

4. While supporting the siderail, press the release push button (A), and remove the foot siderail (see figure 4-36 on page 4-71).

5. Using the 13 mm ratchet wrench, loosen and remove the four screws (B) securing the head siderail support, and recover the spacers (C) (see figure 4-35 on page 4-69).

NOTE:
To make removal of the siderail support more simple, it is assembled so as to rest on the HS structure, even when the screws are removed.

Figure 4-35. Installing the Head Siderail



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NOTE:
The photo is shown with the HS hard surface removed for clarity.

6. Slightly tilt the head siderail assembly and its support inwards then remove it from the bed.

Replacement

1. Set the head siderail to high position with respect to its support and position the head siderail plus support assembly on the HS structure.

2. Perform the removal steps in reverse order.

3. Perform the “Function Checks” on page 2-6.

4.22 Siderail

Identification: (see figure 3-1 on page 3-3)

Time required: 5 min

Number of people: 1

Possibility of intervening with patient on the bed: Yes

Tools required: None

Removal

1. Apply the brakes, raise the sleep surface to the high position, then lower the sleep surface sections to horizontal.

2. Raise and lock the relevant siderail.

CAUTION:
Always set the foot siderail to the folded position. Failure to do so could result in equipment damage.

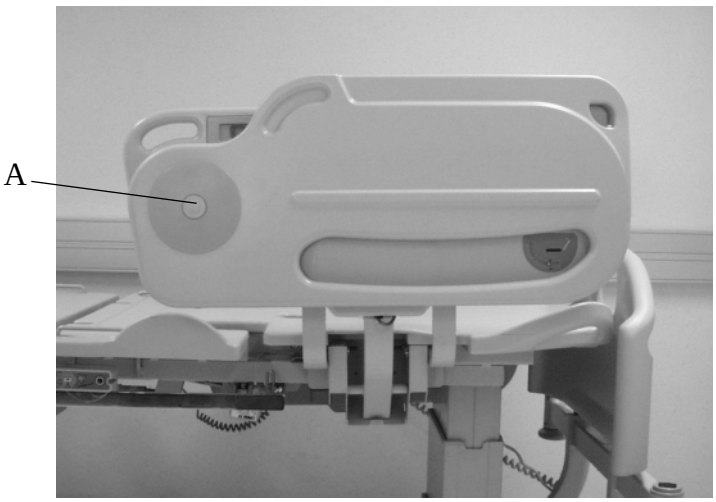
3. Set the foot siderail to the folded position.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

4. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

5. Press the central button (A) of the foot siderail, while holding the other end, then remove it (see figure 4-36 on page 4-71).

Figure 4-36. Folded Foot Siderail



1680_435

Replacement

1. Perform the removal steps in reverse order.

CAUTION:
Always set the foot siderail to the folded position. Failure to do so could result in equipment damage.

2. Perform the “Function Checks” on page 2-6.

4.23 Foot Siderail Support

Identification: (see figure 3-1 on page 3-3)

Time required: 10 min

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 13 mm ratchet wrench

Removal

1. Apply the brakes, raise the sleep surface to the high position, lower the HS to horizontal and raise the TS and the FS to the high position.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

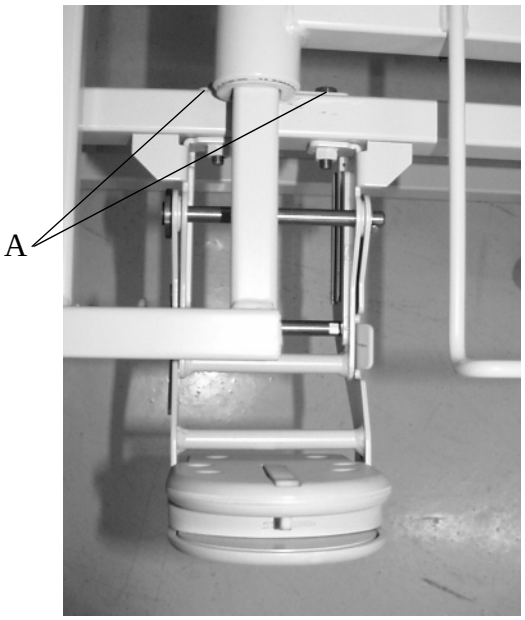
2. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

3. Set the foot siderail to the folded position..

4. Remove the hard surfaces of the TS and the FS (see procedure 4.1 on page 4-5).

5. Using the 13 mm ratchet wrench, remove the 2 screws (A) securing the siderail support and remove the assembly (see figure 4-37 on page 4-73).

Figure 4-37. Foot Siderail Support



1680_417

Replacement

1. Perform the removal procedure in reverse order.
2. Perform the “Function Checks” on page 2-6.

4.24 Head and Footboard

Identification: (see figure 3-1 on page 3-3)

Time required: 5 min

Number of people: 1

Possibility of intervening with patient on the bed: Yes

Tools required: None

Removal

As the head and footboards are not locked, they merely have to be lifted upwards to remove them from their sockets.

Replacement

Install the boards by inserting the two chrome-plated guides of each board into the sockets provided on the bed frame.

4.25 Linen Holder Table (optional)

Identification: (see figure 3-1 on page 3-3)

Time required: 5 min

Number of people: 1

Possibility of intervening with patient on the bed: Yes

Tools required: None

Removal

1. Apply the brakes, raise the sleep surface to the high position, and the TS and the FS to horizontal.
2. Remove the footboard.
3. Pull out the linen holder, then tilt it upwards to remove it from the two guides and pull it towards you to remove it from the bed.

Replacement

1. Perform the removal procedure in reverse order.
2. Ensure that the board slides correctly from its stored to extended position.

4.26 Extension (optional)

Identification: (see figure 3-1 on page 3-3)

Time required: 10 min

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 13 mm ratchet wrench
White petroleum jelly

Removal

1. Apply the brakes, raise the sleep surface to the high position, the TS and the FS to horizontal and remove the footboard.

2. Store the extension and remove the linen holder table (see procedure 4.25 on page 4-75).

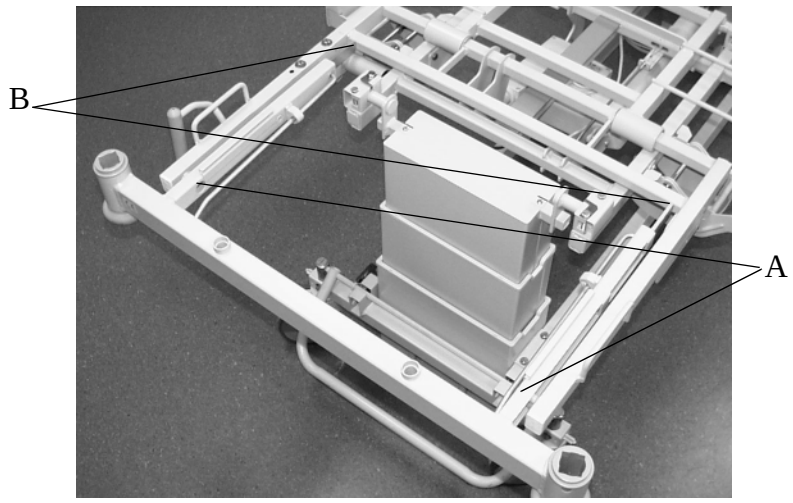
SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

3. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

4. Remove the hard surface of the FS (see procedure 4.1 on page 4-5).

5. Using the 13 mm ratchet wrench, remove the 2 screws (A) supporting the extension while supporting this extension (see figure 4-38 on page 4-77).

Figure 4-38. Extension



1680_438

6. Lift the end of the extension without operating the control lever, then remove the extension plus guide rail assembly from the support notches (B) on the bed.

NOTE:
The two sliderails are assembled with white petroleum jelly (see “Tools and Supply Requirements” on page 6-18).
Two of the extension slide pads are equipped with grounding spring blades.

Replacement

1. Perform the removal procedure in reverse order.

SHOCK HAZARD:
The equipotential link and the grounding of the metal parts of the bed depend on the correct installation of the earth conductor and grounding spring blades. Personal injury could result if the installation is not correct and/or if the earth continuity is compromised.

2. Check that the earth continuity of the accessible metal parts is correct (see “Earth resistance” on page 6-7 in the Preventive Maintenance Schedule).

3. Perform the “Function Checks” on page 2-6.

4.27 Egress Bar

Identification: (see figure 3-1 on page 3-3)

Time required: 10 min

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 13 mm ratchet wrench

Removal

1. Apply the brakes, raise the sleep surface to the high position, the HS, the TS and the FS to horizontal. Store the foot siderails.

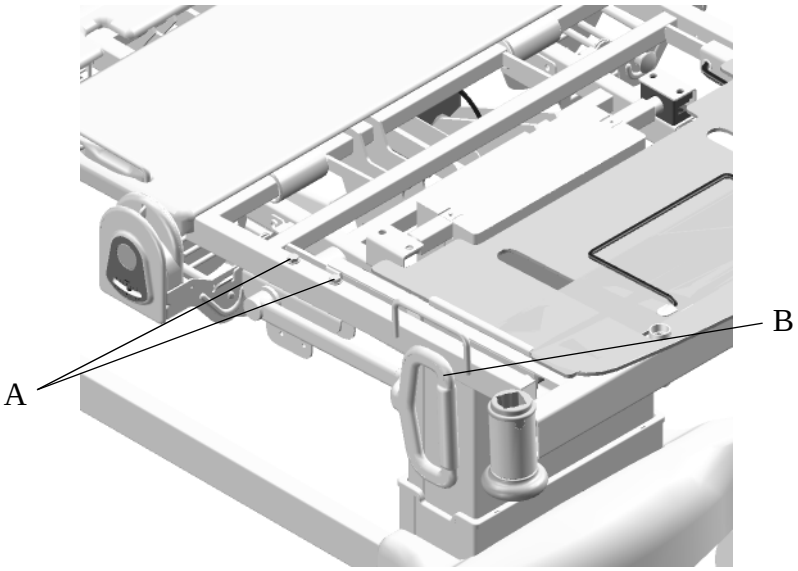
SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

2. Lock out all the functions. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control pendant. If this is not the case, wait for about one minute until the battery mode is deactivated. Press a function button of the control pendant (not the battery button) to ensure that the battery mode is properly deactivated.

3. Remove the hard surface of the FS (see procedure 4.1 on page 4-5).

4. Using the 13 mm ratchet wrench, remove the two screws (A) supporting the egress bar and remove the assembly (see figure 4-39 on page 4-79).

Figure 4-39. Egress Bar Fixation



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Replacement

1. Perform the removal procedure in reverse order.
2. Perform the “Function Checks” on page 2-6.

NOTES :

Chapter 5
Parts List

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5

NOTES:

Warranty

HILL-ROM
LIMITED WARRANTY

Hill-Rom has a long tradition of providing superior quality products and service to our customer. Our goal is "Total Customer Satisfaction." In that spirit, Hill-Rom is proud to offer the following warranty.

GENERAL WARRANTY (APPLICABLE TO ALL CASES IN WHICH A SPECIFIC WARRANTY DOES NOT APPLY).

Hill-Rom warrants to the original purchaser that its products and spare parts shall be free from defects in material and workmanship for a period of one (1) year after date of delivery. Hill-Rom's obligation under this warranty is expressly limited to supplying replacement parts and/or service for, or replacing, at its option, any product which is, in the sole discretion of Hill-Rom, found to be defective. In addition to the foregoing one year warranty, Hill-Rom warrants to the original purchaser that the frame and welds on its beds will be free from structural defects for the life of the bed.

SPECIFIC WARRANTIES

CONSUMABLE WARRANTIES

From the date of delivery, a limited warranty of thirty (30) days applies to consumable items such as cushions, blankets, bed-covers, batteries, program diskettes, detector batteries, incandescent lamps for overhead lighting, fluorescent tubes, heating elements, temperature probes, filtering material and microspheres. This warranty is limited to the replacement of the items covered.

SUPPLY OF PARTS AND SERVICES

Call your approved Hill-Rom Distributor (the address of your national Hill-Rom representative are located on the last page of this manual). In order to expedite service, we request you furnish the following information: customer account number, product model number, serial number, and description of problem. A qualified Specialist will provide, via telephone, troubleshooting assistance for hospital personnel and provide necessary parts to make repairs. If telephone troubleshooting determines the need for on-site technical service, a qualified Territory Service Representative will be dispatched. Replacement of non-technical items will be the responsibility of the customer. At the initiative of Hill-Rom, any products or parts subject to a claim within the scope of this warranty can be returned to the Hill-Rom factories with carriage paid.

AVAILABILITY OF PARTS

For new and remanufactured parts, Hill-Rom will make the parts available for a period of ten (10) years from the date of manufacture of the last model.

Note: Some manufacturer components and assemblies may no longer be available. In this case, elements of equivalent functionality can be substituted.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS WARRANTIES AND IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS OF PURPOSE. HILL-ROM'S OBLIGATION UNDER THESE WARRANTIES SHALL NOT INCLUDE ANY LIABILITY FOR LOSS OF PROFITS, DIRECT, INDIRECT OR CONSEQUENTIAL DAMAGES OR DELAYS. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion or limitation may not apply. Any improper or negligent use, any alterations or repairs not in accordance with Hill-Rom's manuals or performed by others in such manner as in Hill-Rom's judgement affects the product materially and adversely, shall void these warranties. These warranties do not cover material breakdown resulting from improper or abusive use, negligence or an inadequate maintenance routine. No employee or representative of Hill-Rom is authorized to change these warranties in any way or grant any other warranty without the written and signed agreement of a member of the management. These warranties provide specific legal rights; however, there may be other available rights, which vary from state to state.

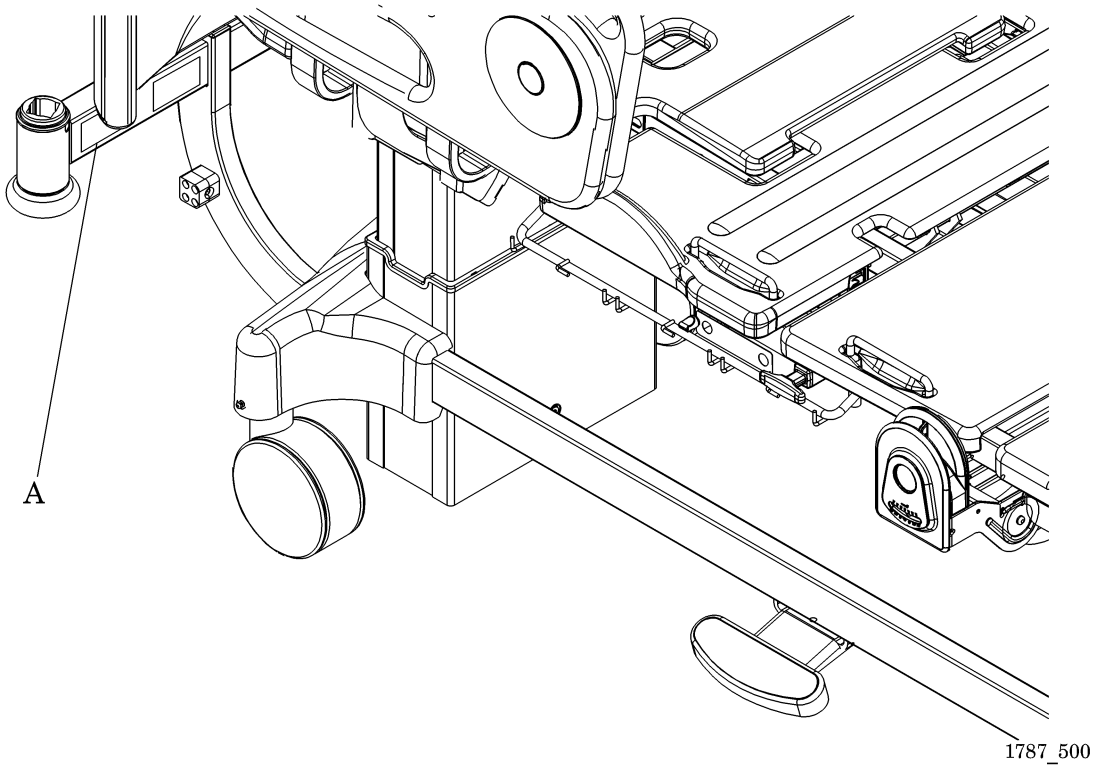
Revised 21 January 2001.

Hill-Rom., B.P. 14 - Z.I. du Talhouët - 56330 Pluvigner - France

Ordering Service Parts.

Use the parts list in this service manual to identify the part numbers you require. Next note the product number and serial number shown on the product identification label (A) (see figure 5-1 on page 5-4).

Figure 5-1. Product Identification Label Location



WARNING:
Do not remove the identification label from the bed, the references featuring on it are essential for identifying the bed and guaranteeing the safety of the maintenance operations. Failure to observe this warning could result in personal injury .

Call the after sales service of your national Hill-Rom representative (refer to the last page of this manual). To help expedite the processing of your parts order, please have the following elements ready when you call:

- Customer account number
- Purchase order number (if available)
- Product code
- Serial number of the bed
- Part reference number(s)

For your convenience, a fax number is available for ordering parts, requesting prices or chasing up an order (refer to the last page of this manual).

Postage will be invoiced for any orders less than 30 Euros.

Delivery within France:

- Standard delivery time: 48 hours
- We can also provide an EXPRESS delivery time of 24 hours.
- Postage paid dispatch.
- Dispatch charges are included in the price of the parts for a standard delivery time within 48 hours in France.
- Parts to be manufactured have a delay of 3 weeks.

Please address all orders to your national Hill-Rom representative to the attention of technical support (refer to the last page of this manual).

Exchange Policy

The conditions specified below apply to any exchange carried out by Hill-Rom during the in-warranty period and out-of-warranty period.

In-Warranty Exchanges

Hill-Rom may request that certain defective products or parts be returned for assessment. You will then be held liable for responding with the 30 days following reception of the spare parts or products. By default, Hill-Rom will invoice the full price of these parts or products.

NOTE:
This invoicing principle applies **exclusively** to the parts or products for which Hill-Rom has requested the return.

In certain cases, the invoice sent with the parts will show the full selling price of the parts. This is for Hill-Rom's internal use only and should not be confused with the price you will actually pay.

Out-of-Warranty Exchanges

Not applicable.

Recommended Spare Parts

For a recommended spare parts list to service 10 AvantGuard™ Beds for 3 years, see table 5-1 on page 5-4.

Table 5-1. Recommended Spare Parts

Reference	Quantity	Description
AG0013	1	Control pendant, **LI158Ax**
AG0014	1	Control pendant, **LI159Ax**
AG0041	1	Control panel on a flexible arm, **LI158Ax**
AG0045	1	Control panel on a flexible arm, **LI159Ax**
AG0049	1	Lateral caregiver unit, left, **without emergency trendelenberg option**
AG0051	1	Lateral caregiver unit, left, **with emergency trendelenberg option**
AG0054	1	Lateral caregiver unit, right, **without emergency trendelenberg option**
AG0055	1	Lateral caregiver unit, right, **with emergency trendelenberg option**
AG0015	1	AC Power cable Europe grey
AG0016	1	AC Power cable U.K.
AG0017	1	AC Power cable Switzerland
AG0048	2	Power supply unit
AG0036	1	Hilow column (40/80 cm)
AG0037	1	Hilow column (45/85 cm)
AG0021	1	Head section actuator
AG0022	1	Thigh section actuator
AG0023	1	Foot section actuator
AG0025	1	Mechanical foot section kit

NOTE:
The spare parts listed above include the different versions of LI158Ax or LI159Ax beds and options. In order to confirm the version of bed that you have, check the identification label. See “Product Identification Label Location” on page 5-4.

Base Frame - Elevation

Figure 5-2. Base Frame - Elevation

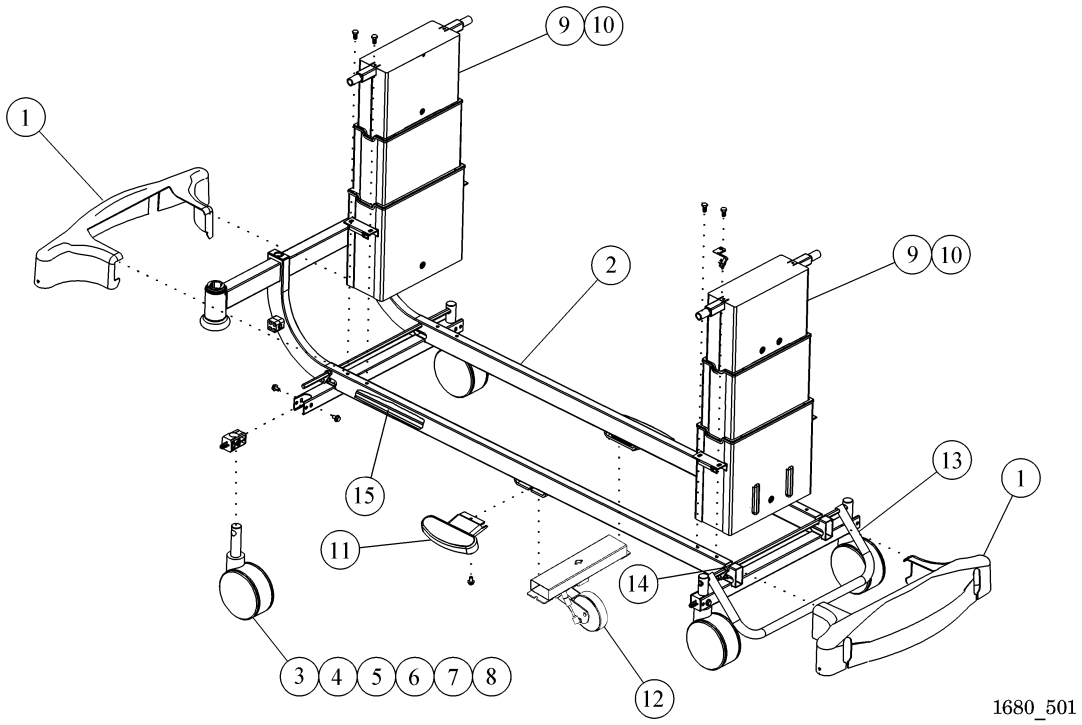


Table 5-2. Base Frame - Elevation

Item Number	Part Number	Quantity	Description
1	AG0028	1	Head and foot cover kit
2	AG0038	1	Base frame kit
Casters 150, single wheel option			
3	AG0057	3	Caster 150, single wheel kit
4	AG0029	1	Caster 150, single wheel, steer kit
Casters 150, double wheel option			
5	AG0058	3	Caster 150, double wheel kit
6	AG0030	1	Caster 150, double wheel, steer kit
Casters 150, single wheel anti-static option			
3	AG0057	1	Caster 150, single wheel kit
4	AG0029	1	Caster 150, single wheel, steer kit
7	AG0031	2	Caster 150, single wheel anti-static kit
Casters 150, double wheel anti-static option			
5	AG0058	1	Caster 150, double wheel kit
6	AG0030	1	Caster 150, double wheel, steer kit
8	AG0032	2	Caster 150, double wheel anti-static kit
9	AG0036	2	Hilow column, 40 - 80 kit
10	AG0037	2	Hilow column, 45 - 85 kit
11	AG0035	2	Bilateral hilow pedal kit
12	AG0007	1	5th wheel kit
13	AG0033	1	Braking mechanism kit
14	AG0034	1	Brake on switch kit
15	AG0059	1	Braking rod kit

NOTE:
All the kits contain their respective fixing systems as well any applicable adhesive labels. Hardware and other small metal or plastic parts are available in the kits.

Intermediate Frame

Figure 5-3. Intermediate Frame

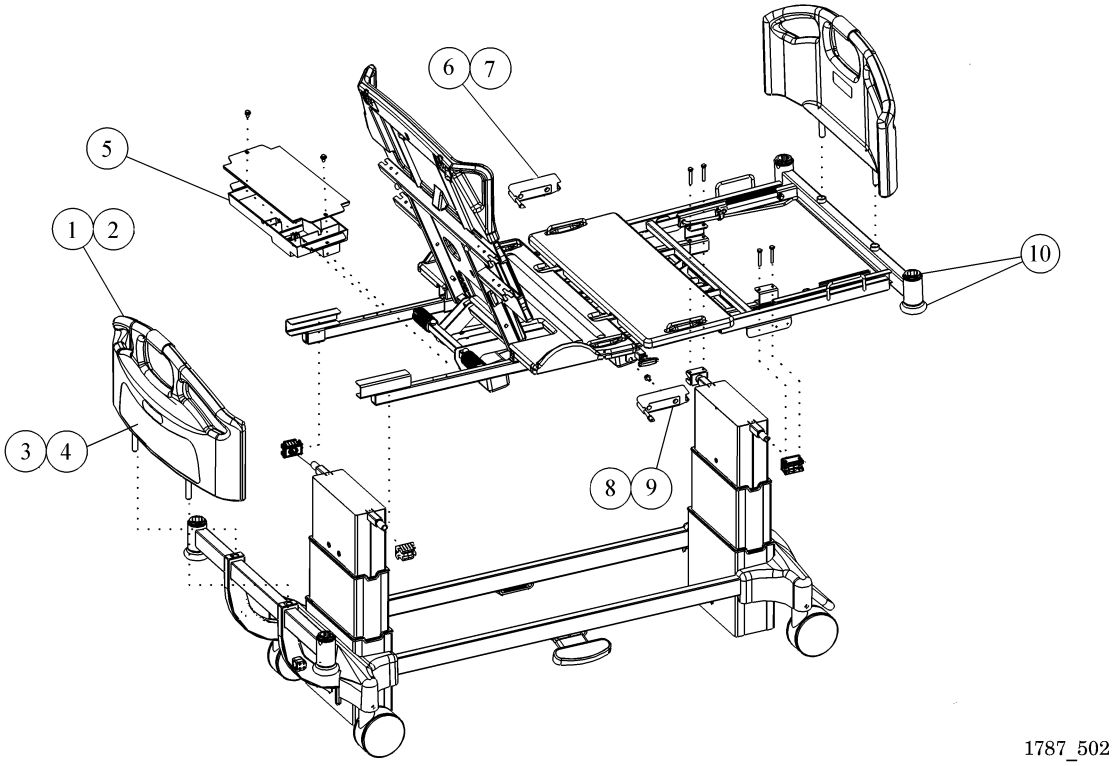


Table 5-3. Intermediate Frame

Item Number	Part Number	Quantity	Description
1	AG0001	2	Head or foot board, LI158Ax
2	AG0065	2	Head or foot board, LI159Ax
3	AG0046	2	Endboard label, LI158Ax
4	AG0066	2	Endboard label, LI159Ax
5	AG0048	1	Power supply unit kit
6	AG0049	1	LCU, left, without emergency trendelenburg option
7	AG0051	1	LCU, left, with emergency trendelenburg option
8	AG0054	1	LCU, right, without emergency trendelenburg option
9	AG0055	1	LCU, right, with emergency trendelenburg option
10	AG0043	1	Bumper kit

NOTE:
All the kits contain their respective fixing systems as well any applicable adhesive labels. Hardware and other small metal or plastic parts are available in the kits.

NOTES:

Sleep Surface

Figure 5-4. Sleep Surface

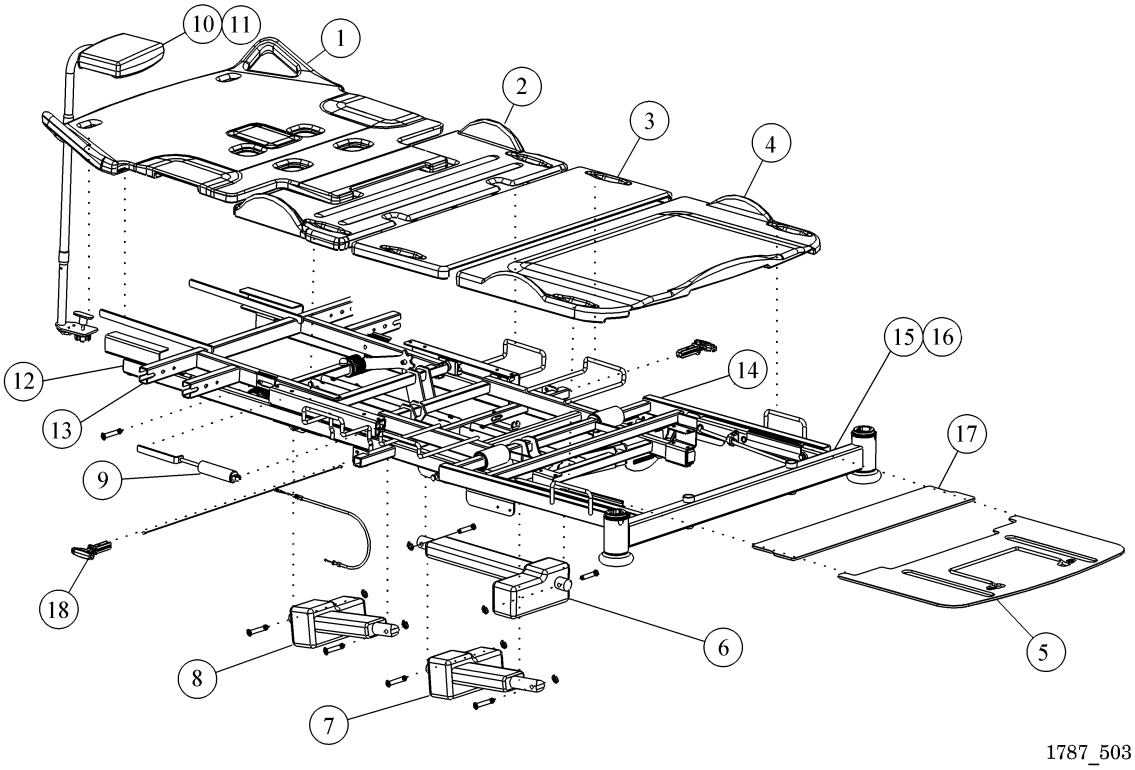


Table 5-4. Sleep Surface

Item Number	Part Number	Quantity	Description
1	AG0005	1	Hard surface, head section kit
2	AG0004	1	Hard surface, seat
3	AG0003	1	Hard surface, thigh
4	AG0002	1	Hard surface, foot
5	AG0006	1	Linen holder kit
6	AG0021	1	Actuator, head section kit
7	AG0023	1	Actuator, foot section kit
8	AG0022	1	Actuator, thigh section kit
9	AG0050	2	Gas spring kit
10	AG0041	1	Control panel on a flexible arm (LI158Ax) kit
11	AG0045	1	Control panel on a flexible arm (LI159Ax) kit
12	AG0026	1	Intermediate frame kit
13	AG0053	1	Head section kit
14	AG0027	1	Fracture kit
15	AG0039	1	Fixed entension kit
16	AG0040	1	Extension kit
17	AG0060	1	Surface support mattress
18	AG0056	1	CPR cable and handles kit

NOTE:
All the kits contain their respective fixing systems as well any applicable adhesive labels. Hardware and other small metal or plastic parts are available in the kits.

Siderail Assemblies

Figure 5-5. Siderail Assemblies

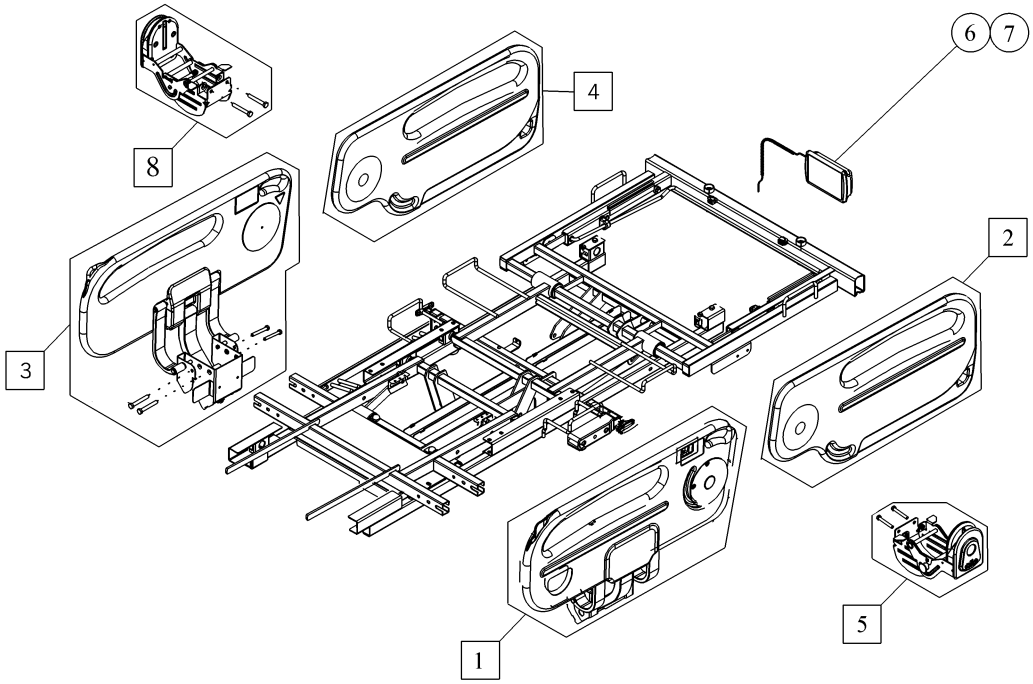


Table 5-5. Siderail Assemblies

Item Number	Part Number	Quantity	Description
1	AG0008	1	Head right siderail kit
2	AG0009	1	Foot right siderail kit
3	AG0011	1	Head left siderail kit
4	AG0012	1	Foot left siderail kit
5	AG0010	1	Foot right siderail support kit
6	AG0013	1	Control pendant, LI158Ax
7	AG0014	1	Control pendant, LI159Ax
8	AG0018	1	Foot left siderail support kit

NOTE:
All the kits contain their respective fixing systems as well any applicable adhesive labels. Hardware and other small metal or plastic parts are available in the kits.

Miscellaneous (Items not Illustrated)

Table 5-6. Miscellaneous (Items not Illustrated)

Item Number	Part Number	Quantity	Description
Not shown	AG0015	1	Power cord, Europe, grey
Not shown	AG0016	1	Power cord, UK
Not shown	AG0017	1	Power cord, Switzerland
Not shown	AG0019	1	Emergency trendelenburg battery and battery backup kit
Not shown	AG0020	1	Emergency trendelenburg battery kit
Not shown	AG0024	1	Battery backup kit
Not shown	AG0025	1	Mechanical foot section kit
Not shown	AG0044	1	Hardware kit (screws, nuts etc.)
Not shown	AG0047	1	Plastic parts kit
Not shown	AG0042	1	Labels set

NOTE:
All the kits contain their respective fixing systems as well any applicable adhesive labels. Hardware and other small metal or plastic parts are available in the kits.

NOTES:

Chapter 6
General Procedures

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6

NOTES:

Cleaning and Care

SHOCK HAZARD:
Unplug the bed before any cleaning or maintenance. Failure to do so could result in personal injury or equipment damage. Refer to the "*AvantGuard™ Electric Bed User Manual*" and to the specific chapters of this manual for any additional cautions and warnings.

General Cleaning

We recommend that you clean the bed with detergent and warm water. Do not use excessive liquid or harsh cleansers.

Steam Cleaning

Do not use any steam cleaning device on the AvantGuard™ Electric Bed. The excessive moisture can damage mechanisms and components in the bed.

Hard to Clean Spots

To remove difficult spots or stains, we recommend that you use standard household cleansers and a soft bristle brush. To loosen heavy, dried-on soil, you may first need to saturate the spot.

Disinfection

Dilute disinfectants and/or germicides as specified on the manufacturer's label.

Storing the Bed

For prolonged storage, the bed must be in the low position, covered, damp-proofed and at a temperature of between 0° and 40°C. Do not use the bed as a support (for working or storage) during the storage period.

For a bed fitted with a battery: during storage, it is recommended to recharge the battery every three months.

After prolonged storage, it is also advisable to plug the bed into the power outlet for 10 hours to fully recharge the battery before using the bed.

Always let the bed reach room temperature before using the bed after prolonged storage.

Lubrication Requirements

Certain parts of the AvantGuard™ Electric Bed must be lubricated at least once a year for optimum performance. Consult the preventive maintenance schedule.

Preventive Maintenance

WARNING:
Only the facility-authorised maintenance personnel should perform preventive maintenance on the on the AvantGuard™ Electric Bed. Preventive maintenance performed by unauthorised personnel could result in personal injury or equipment damage.

The AvantGuard™ Electric Bed should be subject to an efficient maintenance programme. This will ensure the long life and productivity of the AvantGuard™ Electric Bed and help to reduce downtime due to excessive wear failures.

An annual service of the bed is advised in order to maintain its characteristics and performance.

Every 3 years, the electrical equipment should be inspected by an approved after-sales service technician, in order to obtain consistent equipment performance over time.

The life-time of the hilow, head section, thigh section and foot section actuators is 5 years, the power supply unit, the control pendant, the control panel on a flexible arm and the gas springs is 10 years, for average use. The actuators should be replaced after these periods.

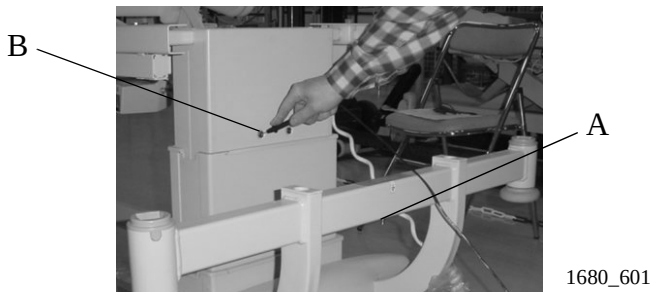
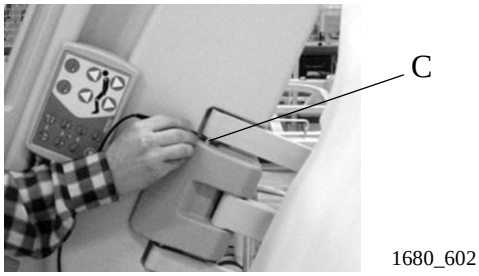
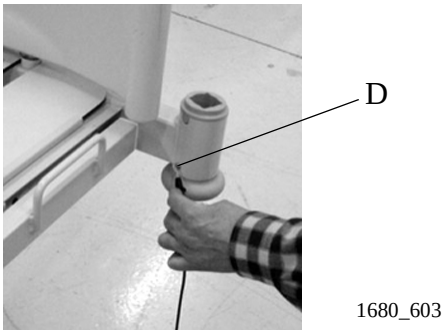
Preventive Maintenance Schedule

The following preventive maintenance schedule is a reminder designed to guide the technician through a normal preventive maintenance procedure on the AvantGuard™ Electric Bed. Check each element of the schedule and carry out all the necessary adjustments during the preventive maintenance procedure.

The preventive maintenance schedule is intended to be used in conjunction with the preventive maintenance checklist following it. This checklist is designed to keep a running history of maintenance and subsequent repair costs for the AvantGuard™ Electric Bed. Keeping close records and maintaining the AvantGuard™ Electric Bed are two good ways to reduce downtime and at the same time, keep the nursing staff happy and efficient.

Table 6-1. Preventive Maintenance Schedule

Function	Procedure
Overall condition, frame and welded assemblies	Check the overall aspect of the bed. Check that the structure and welded assemblies are in good working condition and that there are no impacts or corrosion. Carry out any necessary repairs or paint retouches (see “Tools and Supply Requirements” on page 6-18), replace if necessary. Observe the symmetry of the bed and check that the bed frame and base are not twisted. Carry out any necessary repairs or paint retouches (see “Tools and Supply Requirements” on page 6-18). Check that all labels are fitted; replace them if necessary (references: see chapter 5).
Head and footboards	Check the appearance, attachment and safety of the head and footboards. Replace if necessary.
AC power cable	Check that there are no cuts, scrapes or breaks in the AC power cable or connector. Replace the AC power cable if necessary.

Function	Procedure
Earth resistance	Check the condition of the grounding straps of the bed. Replace them if they are damaged or cut. Measure the resistance to earth **between the earth terminal of the power connector and the following points (exposed metal):** • Point 1: Equipotential terminal (A) (see figure 6-1) • Point 2: Head side upper column screw (B) (see figure 6-1) • Point 3 & 4: Right and left hand siderail internal pins (C) (see figure 6-2) • Point 5: Right or left hand foot accessory support screw (D) (see figure 6-3) Use a Portable Appliance Tester (PAT) or a Digital MultiMeter (DMM) for this check. This value must be less than 0.2 ohms. **Figure 6-1. Equipotential Terminal and Column Screw**  **Figure 6-2. Siderail Internal Pins**  **Figure 6-3. Foot Accessory Support Pin** 

Function	Procedure
Leakage current	Unplug the power connector from the power outlet. Connect the power connector of the bed to the test device and connect this device to the power outlet. Check that the bed is correctly supplied by the test device: control unit LEDs lit (unlock the functions if necessary). Take leakage current measures (but without operating any function) Use a Portable Appliance Tester (PAT) or a Digital MultiMeter (DMM) for this check. The value must be less than 500 µA. Check the AC power cable and power supply unit if the value is outside of the specifications. Replace the AC power cable or power supply unit if necessary. Connect to an appropriate power source following of this test
Lateral caregiver unit	Check the condition of the labels. Replace if necessary. Check the condition of the female connector (behind LCU) Check that no object is in the openings for the two control units. Activate the function lockout sequence and check that the LEDs flash on the control pendant. Exit the lockout sequence and ensure that the LEDs do not flash any longer. If emergency trendelenburg function is fitted (optional), operate the emergency trendelenburg function and ensure that the bed changes to trendelenburg correctly and that the head section lowers. Make sure that the movement stops when the LCU key is released. If the bed is fitted with “Battery Backup” option, unplug the power connector from the power outlet and carry out cycles on different sections. The “Low battery” LED must light up after a certain time. Note that the number of cycles depends on the charged condition of the battery. Carry out these operations on both LCU. Replace if necessary or troubleshoot in the event of a doubt (see RAP 2.2, RAP 2.13 or RAP 2.8).

Function	Procedure
Control pendant	Disconnect the control pendant of the lateral caregiver unit and check the condition of its connector. Then reconnect or replace the control unit if necessary. Activate the sequence of “function selection/lockout/ trendelenburg/reverse trendelenburg access” and lock out all the functions. Ensure that the LEDs are then unlit except for the trendelenburg/reverse trendelenburg which remains continuously lit. Without exiting the “function selection/lockout” sequence, unlock all the functions and ensure that all the LEDs flash, except for the trendelenburg/reverse trendelenburg LED which remains continuously lit. Test the two buttons of the trendelenburg/reverse trendelenburg function to check that they activate the correct function. Exit the sequence of “function selection/lockout/ trendelenburg/reverse trendelenburg access.” Ensure that the LED of each function remains continuously lit and that the trendelenburg/reverse trendelenburg LED goes out. Test each of the buttons to check that they activate the correct function and that they do not work intermittently by pressing each button for several seconds. Each movement must be continuous. Replace the control unit if necessary. Troubleshoot in the event of a doubt (see RAP 2.2).
Control unit on a flexible arm (optional)	Perform the same tests as for the control pendant. Replace if necessary. Troubleshoot in the event of a doubt (see RAP 2.2).
Hilow columns	Inspect the column assembly for the presence and tightness of the attachment screws. Carry out a full raise/lower cycle of the bed frame Check that there is no friction or abnormal noises and that no audible overload indication can be heard during the movement. Check that the non-low bed position LED lights up on the control pendant and extinguishes when the bed is in low position. Replace the defective column(s) in the event of a malfunction. Troubleshoot in the event of a doubt (see RAP 2.4).

Function	Procedure
Hilow pedals (optional)	Activate the raise and lower controls of the bed by means of the pedals and check that the working of the corresponding functions. Replace the pedals if necessary.
Retractable Head Section (RHS)	Inspect the actuator assembly, check that the pins and Truarc®[a] circlips are not missing. Carry out a full raise/lower cycle of the corresponding section. Check that there is no friction or abnormal noises and that no audible overload indication can be heard during the movement. Replace in the event of a malfunction.
Retractable Head Section (RHS) and corresponding hard surface	Inspect the hard surface assembly, check that the pins and Truarc® circlips are not missing. Carry out a full raise/lower cycle of the head section. Check that the articulation moves through approximately 10 cm along the plane of the bed frame during the elevation movement. Check that the hard surface moves approximately 4 cm on the section during the movement. Check that the hard surface and its drive system under the head section are in good condition. Check that there is no friction or abnormal noises. Replace any damaged parts (refer to procedure 4.1).
Hard surfaces of the bed frame	Remove each hard surface and check its condition (refer to procedure 4.1). Replace if necessary.
CPR release	Inspect the assembly of the handles, cable and CPR mechanism at the RHS actuator. Check that the screws are present and fully tightened. Check the condition of the two CPR release handles, cable and CPR mechanism at the RHS actuator. Operate the HS raise up to the high position by using the control pendant then activate one of the CPR releases. Ensure that the head section lowers. Carry out the same tests on the other side of the bed. Release the CPR handles and check that the mechanism relocks correctly by operating the RHS raise for a few seconds. The elevation movement must be observed. Replace the RHS actuator assembly in the event of a malfunction or broken cable.

Function	Procedure
Head section gas springs	Inspect the assembly of the gas springs. Check that the screws are present and fully tightened. Check that there is no oil on its shaft. Operate the HS raise up to the high position by using the control pendant then activate one of the CPR releases. Ensure that the HS lowers rapidly to the intermediate position then gradually to the low position. Replace the gas springs if necessary (refer to procedure 4.19).
Thigh section actuator	Inspect the assembly of the actuator. Check that the pins and Truarc® circlips ar not missing. Carry out a full raise/lower cycle of the corresponding section. Check that there is no friction or abnormal noises and that no audible overload indication can be heard during the movement. Replace in the event of a malfunction (refer to procedure 4.10).
Automatic Contour	Check that the TS Section rises up to mid-height when the "HS raise" function is activated from the low position, and that it lowers automatically when the "HS lower" function is activated and the HS section reaches low position. Troubleshoot and replace the actuator or defective unit if necessary (see RAP 2.7).
Foot section actuator (LI159Ax)	Activate the thigh section raise up to mid-height. Inspect the assembly of the foot actuator. Check that the pins and Truarc® circlips are not missing. Carry out a full raise/lower cycle of the foot section. Check that there is no friction or abnormal noises and that no audible overload indication can be heard during the movement. Replace in the event of a malfunction or abnormal noises (refer to procedure 4.11).
EasyChair™ Chair function (LI159Ax)	Ensure that the Chair, HS, TS and FS functions are not locked out. Activate the chair function and check that the three sections are correctly activated to reach the required position. Activate the control “exit from chair position”: mark “O” of the chair function and check that the three sections return correctly to the low position. Troubleshoot in the event of a malfunction (see RAP 2.11**).**

Function	Procedure
Mechanical foot section (LI158Ax)	Activate the thigh section raise up to mid-height. Inspect the assembly of the foot actuator and its control lever. Check that the pins and Truarc® circlips are present and fully tightened. Carry out a full raise/lower cycle of the foot section by raising and lowering it manually when the lever has be used. The foot section only must rise when the lever is operated. A certain amount of force must be used when lowering the section manually. Check that there is no friction or abnormal noises and that the movement correctly cushioned when lowering section. Check that the section locks correctly when the lever is released. Check that there is no oil on the actuator rod. Replace the gas spring assembly if necessary (refer to procedure 4.20).
Trendelenburg/ reverse trendelenburg (according to configuration)	Activate the “function selection/lockout/ trendelenburg/ reverse trendelenburg access” sequence on the lateral caregiver unit. Operate the sleep surface trendelenburg. Check that there is no friction or abnormal noises and that no audible overload indication can be heard during the movement. Operate the trendelenburg. Check that there is no friction or abnormal noises and that no audible overload indication can be heard during the movement. Exit the “function selection/lockout” sequence. Replace the defective part in the event of a malfunction or abnormal noises. Troubleshoot in the event of a malfunction, (see RAP 2.12**).**

Function	Procedure
Emergency trendelenburg function (according to configuration)	Adjust the bed to “Chair” position and the bed frame horizontal. Operate the emergency trendelenburg function successively from the two lateral caregiver units. Ensure that the sleep surface moves into trendelenburg, that the three head, thigh and foot sections move to horizontal without friction or abnormal noises and that no audible overload indication can be heard during the movement. Operate the adjustment of the sleep surface to horizontal position then unplug the power connector from the power outlet. Operate the Emergency trendelenburg function again and ensure that the function works correctly without AC power. Reconnect the battery backup if the bed is equipped with one. Recharge the emergency trendelenburg function battery or replace it if the function only works with the AC power applied. Troubleshoot in the event of a malfunction (see RAP 2.14**).** In all cases, check the date indicated on the battery, it is recommended to replace the battery if the date is over five years.
Operation on battery backup (according to configuration)	Ensure that the bed is unplugged from the power outlet and operate all the functions using the control unit. Recharge the batteries or replace them if necessary. Troubleshoot in the event of a malfunction (see RAP 2.8**).** In all cases check the date indicated on the battery, it is recommended to replace the battery if the date is over five years.
Siderail structure and attachment	Check that the head and foot siderails are not bent or twisted. Check that the rotation and release system of each foot siderail is in good condition. Fold back the foot siderails and check that the release control of each head siderail operates correctly. Check the condition of the elevation mechanism of each head siderail. Test that they lock correctly in high position by pushing them sideways. Note that the guide rods on the siderails are self-lubricating. Replace the foot siderails or head siderail subassembly if necessary (refer to procedure 4.22 or procedure 4.23).

Function	Procedure
Foot siderail locking mechanism	Fold back the foot siderails on the head siderails. Inspect the foot siderail suport assembly and check that the springs, pins and Truarc® circlips are fitted and that the securing screws are tightened. Operate the unlocking latch of each siderail support so as to lower then raise it to high position to ensure that the support locks correctly. Deploy the foot siderails on the supports and ensure that the siderail locking mechanism operates correctly on each support. Check the operation of the trendelenburg/reverse trendelenburg angle indicators. Replace if necessary (refer to procedure 4.23).
Extension (optional)	Operate the extension to check that its movement is correct and that it locks properly into the different positions when the lever is released. Lubricate the guide rails with white petroleum jelly (see “Tools and Supply Requirements” on page 6-18). Replace the defective or missing parts (refer to procedure 4.26).
Linen holder (optional)	Check that the linen holder operates correctly. Replace the damaged or missing parts if necessary (refer to procedure 4.25).
Articulated joints	Check that the articulations of the bed operate without making any noise (HL column bearings, head and thigh sections).
Mobibar™ Egress Bar (optional)	Deploy each egress bar and ensure that they lock in high position. Operate each release lever and ensure that the corresponding lever folds correctly. Replace if necessary.
Casters	Check for cuts, wear and quality of the tread, etc. Replace if necessary (refer to procedure 4.17).
Braking and steering	Check the brakes to see whether the bed moves when the brake bar is pressed. Adjust if necessary (refer to procedure 4.17 on page 4-56). Check the steering mechanism. Replace or adjust the steering control elements of the steering caster if necessary. Replace the caster if necessary (refer to procedure 4.16).
5th wheel steering system (optional)	Ensure that the 5th wheel locks correctly when the bed is moved in a straight line and unlocks when a sideways force is applied. Replace the system if necessary (refer to procedure 4.18).

Function	Procedure
Detection of “Bed connected to AC power but brakes not applied” (optional)	Plug the bed into the power outlet and set the brake bar to neutral. The alarm must be heard. Apply the brakes on the bed. The alarm must stop sounding. Troubleshoot in the event of a malfunction (refer to procedure 2.15)**.**
Accessory support bar and medical equipment support bar medical device support rail (according to configuration)	Check the position of each bar on the bed and that the securing screws are correctly tightened. Replace any missing or damaged parts if necessary (refer to procedure 7.1 or procedure 7.2).
Administrative procedures	Carry out all the necessary administrative procedures.

a. Truarc® is a registered trademark of Waldes Truarc, Inc.

Preventive Maintenance Checklist

Table 6-2. Preventive Maintenance Checklist

Date																						**Functions**
Manufacturer: Hill-Rom																						Overall condition
																						Head and footboards
																						AC power cable
																						Earth resistance
																						Leakage current
																						Power supply unit
Model number																						Lateral caregiver unit
																						Control pendant
																						Control panel on a flexible arm
																						Hilow columns
																						Hilow pedal
Serial number																						
																						Head section actuator
																						Head section
																						Bed frame hard surfaces
																						CPR release
																						Automatic contour
																						Foot section actuator
																						Chair function
Total cost for this page																						**Labour:**
																						Repair cost:
																						Inspected by:
																						Legend: L = Lubrification N = Cleaning A = Adjustment R = Repair/ Replacement O = Okay N = Not Applicable

Date																						**Functions**
Hill-Rom	**Manufacturer:**																					Mechanical foot section
																						Trendelenburg/reverse trendelenburg
																						Emergency trendelenburg function
																						Battery backup
																						Siderail structure
	Model number																					Foot siderail supports
																						Extension
																						Linen holder
																						Articulation points
																						Egress bars
																						Casters
																						Braking and steering
	Serial number																					5th wheel steering system
																						Detection of “Brake not applied”
																						Accessory support and medical device support rails
																						Administrative procedures
Total cost of this page																						**Labour:**
																						Repair cost:
																						Inspected by:
																						Legend: L = Lubrification N = Cleaning A = Adjustment R = Repair/ Replacement O = Okay N = Not Applicable

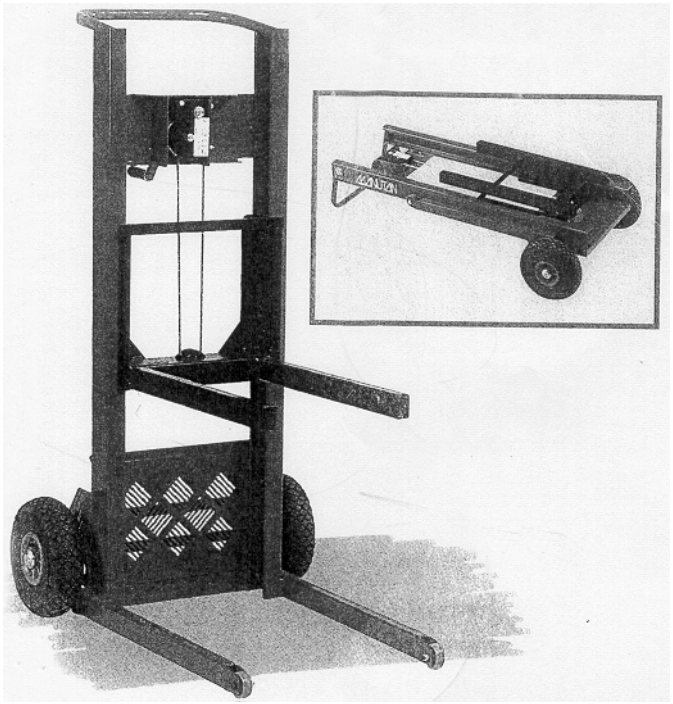
Tools and Supply Requirements

To service the AvantGuard™ Electric Bed, the following tools and supplies are required:

- Ratchet wrench (Facom P/N S.151)
- Extension (Facom P/N S.210)
- 13 mm rod (12 sided) (Facom P/N S.13)
- 6 mm combination spanner (Facom P/N 39.6)
- 8 mm combination spanner (Facom P/N 39.8)
- 10 mm combination spanner—2 required (Facom P/N 39.10)
- 13 mm combination spanner (Facom P/N 39.13)
- 17 mm combination spanner (Facom P/N 39.11)
- T25 Torx®[1] key (Facom P/N 89S25)
- 6 mm Allen®[2] key (Facom P/N 82H6)
- 10 mm Allen® key (Facom P/N 82H10)
- Small screwdriver (Facom P/N AR.3x75)
- #2 phillips head screwdriver (Facom P/N AP.2x100)
- Soft faced hammer
- 8 mm pin punch (Facom P/N 249.8)
- Elevation tool (P/N AG0052) (see figure 6-4 on page 6-19)
- Test control unit (P/N AG0061)
- HL column simulation connector (P/N AG0062)
- TS and FS actuator simulation connector (P/N AG0063)
- HS actuator simulation connector (P/N AG0064)
- Loctite®[3] 242 adhesive
- Beige retouching paint bottle (P/N CO0400)
- Pot of white petroleum jelly (approx. 400 g) (P/N CO1131)

1. Torx® is a registered trademark of Textron, Inc.
2. Allen™ is a trademark of Industrial Fasteners, Inc.
3. Loctite® is a registered trademark of Loctite Corporation, Inc.

Figure 6-4. Elevation Tool (P/N AG0052)



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NOTES:

Chapter 7
Accessories

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NOTES:

Accessories

WARNING:
Only the accessories specifically identified below are authorised to be used on the AvantGuard™ Electric Bed. Any use of accessories not included in the list may compromise the safety of the AvantGuard™ Electric Bed.

WARNING:
Consult the *AvantGuard™ Electric Bed User Manual* before using the accessories to prevent any risk of injury to the patient or user.

Table 7-1. Accessories List

Reference	Description
AC908A	2 receptacle bottle holder
AC932A	Stainless steel bottle holder—1 litre
AC938A	Stainless steel bottle holder—2 litres
AC961A	Stainless steel bottle holder—3 litres
AD016A	Semi-spherical urine holder—France
AC991A	Triangular section urine holder
AC959A	Pivoting oxygen cylinder holder for B5 bottle—diameter 150 mm
AC962A	Pivoting stainless steel bottle holder—3 litres
AD101A	Pivoting oxygen cylinder holder for D bottle—diameter 110 mm
AD102A	High pivoting oxygen cylinder holder for E bottle—diameter 110 mm
AC963A	Syringe-driver holder table
AC968A	Equipotential cable
AD080B	Chrome-plated patient helper
AD081B	Adjustable patient helper
AD082A	Stainless steel I.V. pole
AC953A	I.V. hooks on patient helper
AD128A	Monitor stand table
AC923A	Label holder
AD126A	Accessory support bar kit
AD127A	Medical device support rail kit
AD066A	Cliniplot® III Mattress
AD085A	Primo™ Dynamic Low Pressure Mattress System
AD117A01	Clinisert 2™ Mattress
AD118A01	Clinisert 2™ Mattress

Reference	Description
AD119A01	Clinisert 2™ Mattress
AD120A01	Clinisert 2™ Mattress
AD140A	Duo 2™ Multi Mode Mattress System
AD052C	Climat System™ mattress
AD142A	AvantGuard™ Electric Bed removable frame
AD082A	Stainless steel I.V. pole with elbow
AC806A	I.V. pole support 5-branch socket
9099007A	Cane holder
AD134A	MobiBar™ Egress Bar kit
AD135A	Self-steering 5th wheel kit
AD136A	Control panel on a flexible arm kit
AD137A	Hilow pedal kit
AD138A	Extension kit
AD139A	Linen holder kit

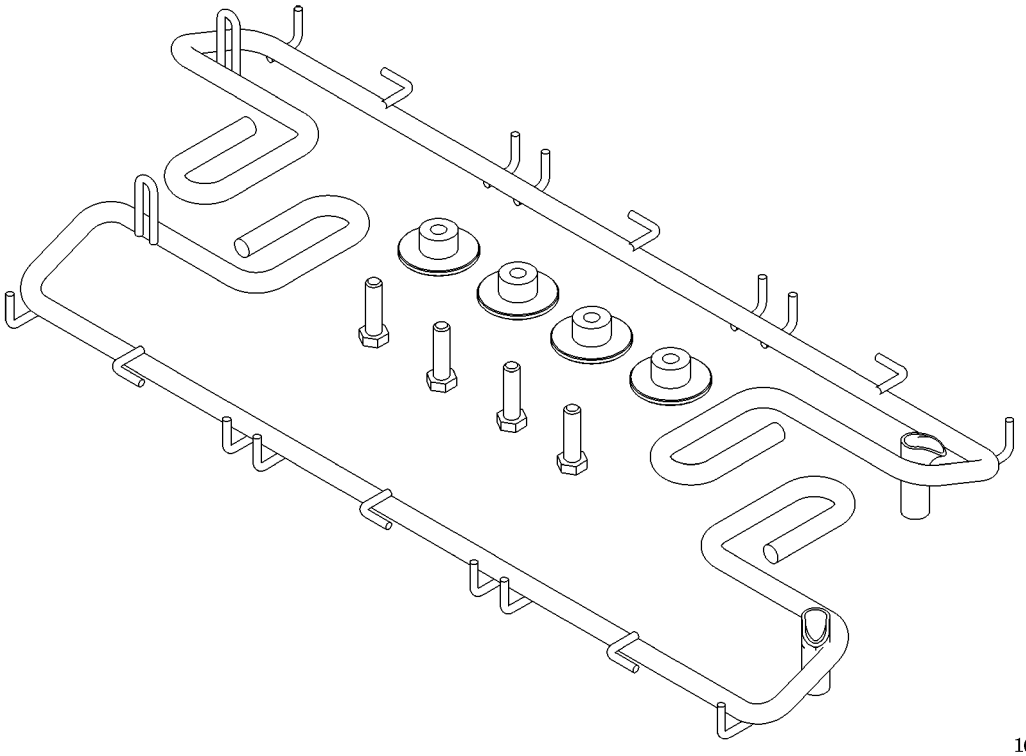
7.1 Accessory Support Bar Kit - AD126A

This kit contains the accessory support bars and the parts that enable them to be installed on the bed. Note that only one accessory support bar can be installed on the bed if the use of a medical device support rail is required (other kit).

The accessory support bar kit includes the following:

- Two accessory support bars (one right hand and one left hand)
- Four guides
- Four securing screws

Figure 7-1. Accessory Support Bar Kit



1680_746

Identification: (see figure 3-1 on page 3-3)

Time required: 10 min

Number of people: 1

Possibility of intervening with patient on the bed: Yes

Tools required: 6 mm Allen™[1] key

1. Allen™ is a trademark of Industrial Fasteners, Inc.

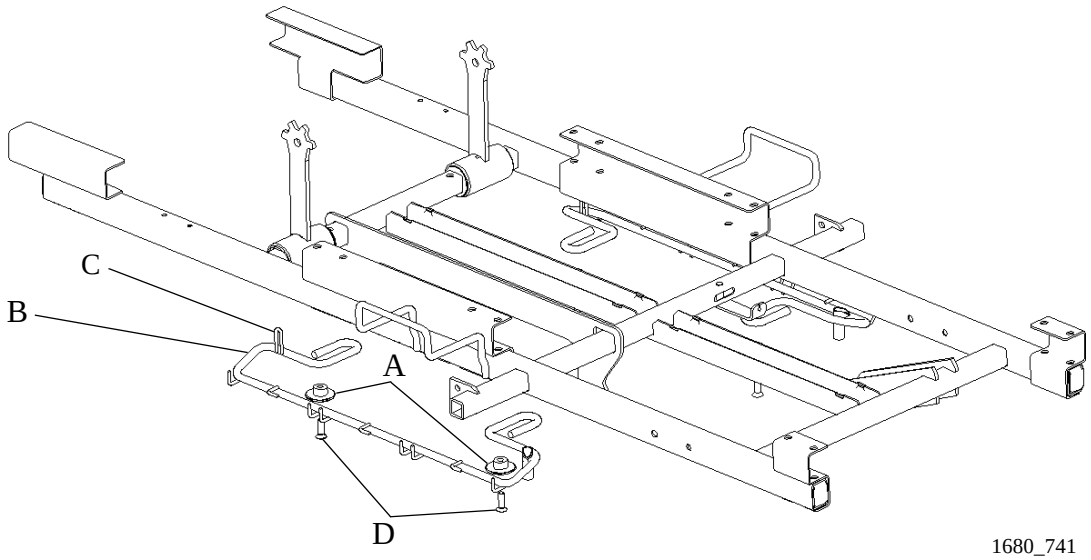
Installation

1. Check the composition of the kit.
2. Apply the brakes, adjust the bed to high position, the sleep surface horizontal and the siderails to high position.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

3. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control unit. If this is not the case, wait for approximately one minute until the battery mode is deactivated.
4. Position the two guides (A) in the spaces provided on the accessory support bars (B) and position the assembly below the holes to the right or left of the bed frame. Ensure that the socket (C) of each support bar is located at the head end of the bed (see figure 7-2 on page 7-6).

Figure 7-2. Installing the Accessory Support Bars



5. Fit the two securing screws (D) of the accessory support bars and lock them using the 6 mm Allen™[1] key.
6. Repeat steps 4 and 5 to install the other accessory support bar on the other side of the bed frame.

Removal

Perform the installation procedure in reverse order.

1. Allen™ is a trademark of Industrial Fasteners, Inc.

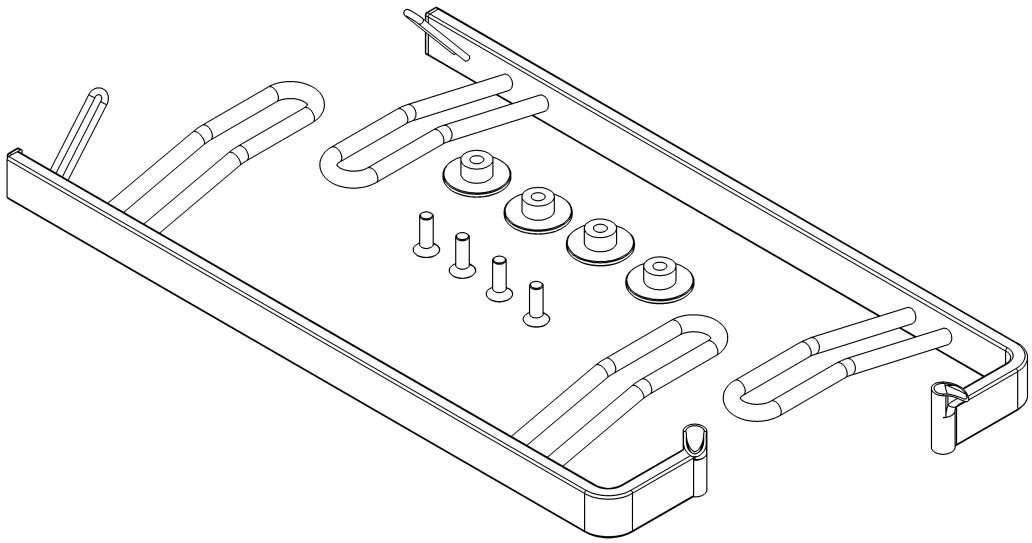
7.2 Medical Device Support Rail Kit - AD127A

This kit contains the medical device support rails and the parts that enable them to be installed on the bed. Note: Only one medical device support rail can be installed on the bed if the use of an accessory support bar is required (other kit).

The medical device support rail kit includes the following:

- Two medical device support rails (one right hand and one left hand)
- Four guides
- Four securing screws

Figure 7-3. Medical Device Support Rail Kit



1680_745

Identification: (see figure 3-1 on page 3-3)

Time required: 10 min

Number of people: 1

Possibility of intervening with patient on the bed: Yes

Tools required: 6 mm Allen™[1] key

1. Allen™ is a trademark of Industrial Fasteners, Inc.

Installation

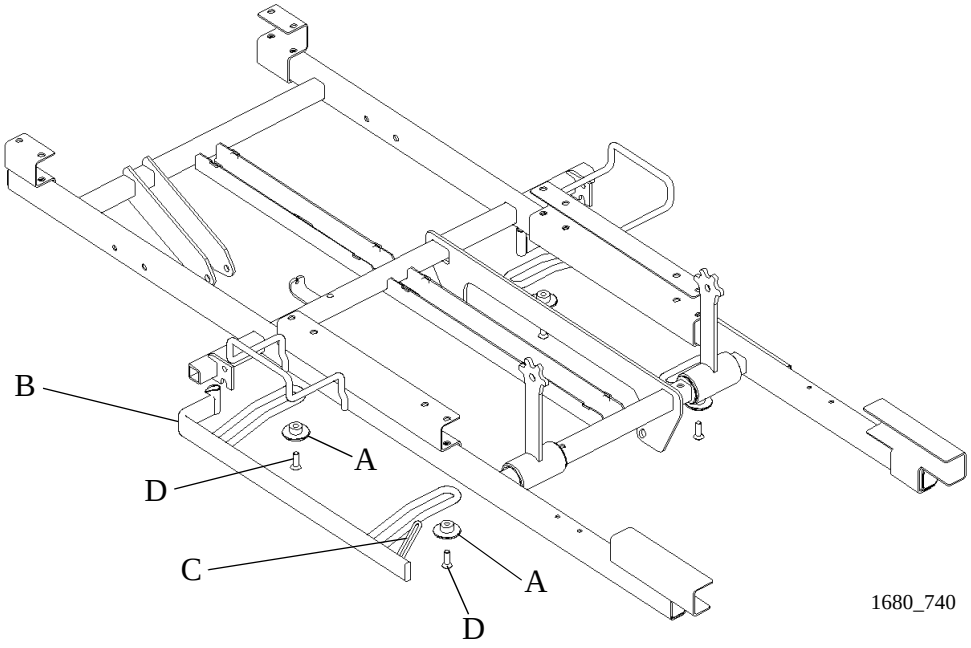
1. The medical device support rails are located in the same sockets as the accessory support bars and are installed in the same manner.

2. Position the two guides (A) in the spaces provided on the medical device support rail (B) and position the assembly below the holes to the right or left of the bed frame. Ensure that the rod (C) of each medical device support rail is be located at the head end of the bed (see figure 7-4 on page 7-8).

3. Fit the two securing screws (D) of the medical device support rail and lock them using the 6 mm Allen™[1] key.

4. Repeat steps 2 and 3 to install the other medical device support rail on the other side of the bed frame.

Figure 7-4. Installing the Medical Device Support Rails



Removal

Perform the installation procedure in reverse order.

1. Allen™ is a trademark of Industrial Fasteners, Inc.

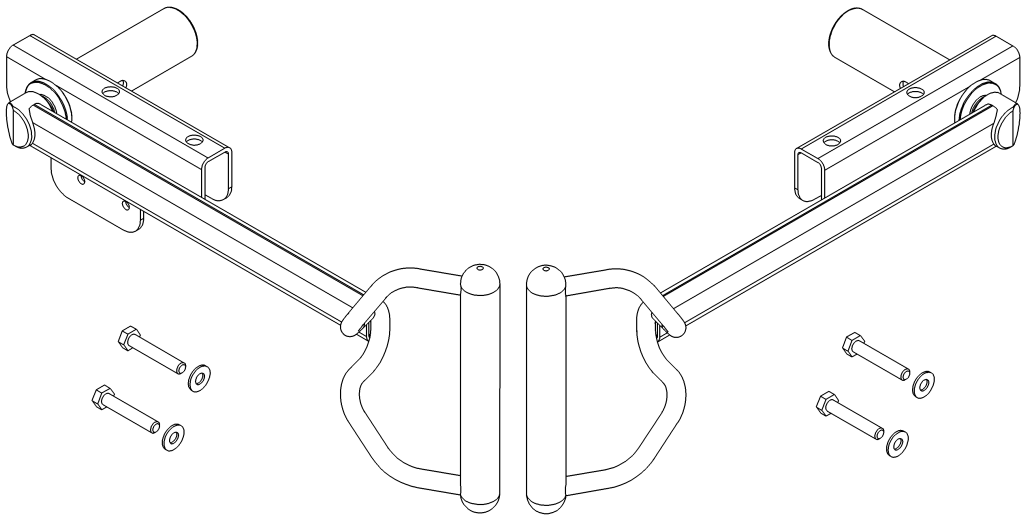
7.3 MobiBar™ Egress Bar Kit - AD134A

This kit contains the two egress bars and the parts that enable them to be installed on the bed.

The MobiBar™ Egress Bar kit includes the following:

- Two MobiBar™ Egress Bars—one right hand and one left hand
- Four securing bolts
- Four washers

Figure 7-5. MobiBar™ Egress Bar Kit



1680_743

Identification: (see figure 3-1 on page 3-3)

Time required: 10 min

Number of people: 1

Possibility of intervening with patient on the bed: No

Tools required: 13 mm ratchet wrench

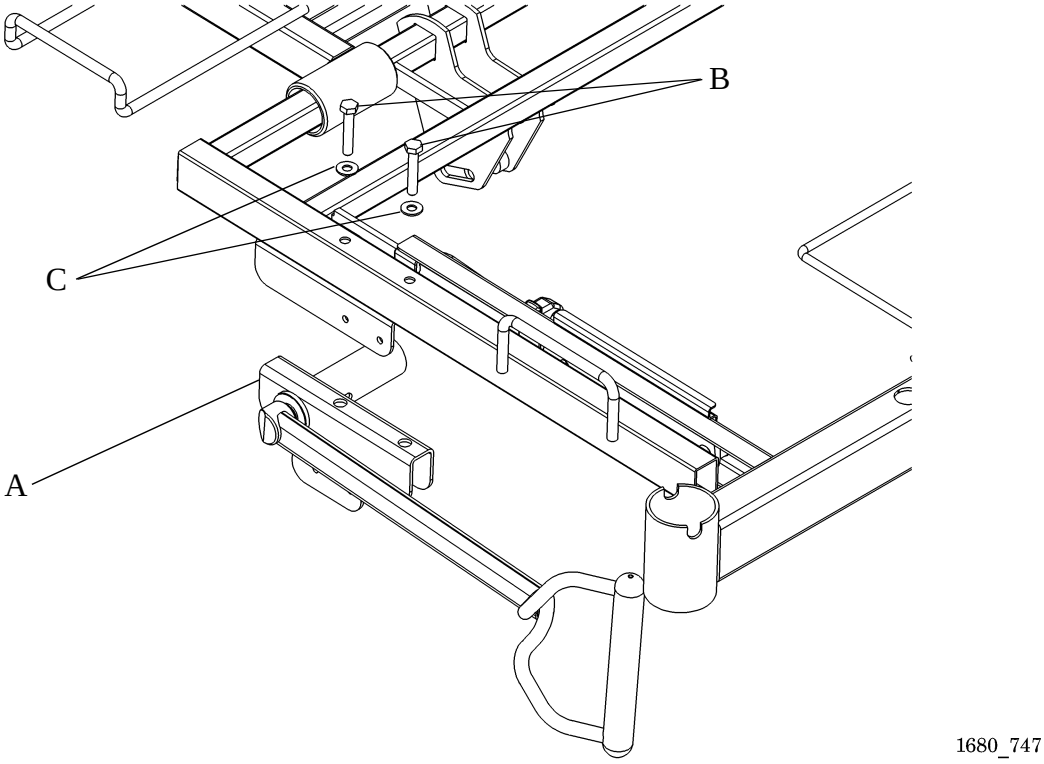
Installation

1. Apply the brakes, adjust the bed to high position, the head, thigh and foot sections horizontal. Lift the foot siderails.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

2. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control unit. If this is not the case, wait for about one minute until the battery mode is deactivated.

Figure 7-6. Installing the MobiBar™ Egress Bar



3. Remove the hard surface of the foot section (refer to procedure 4.1).

4. Position one of the egress bars (A) at the location provided on the bed frame (see figure 7-6 on page 7-10).

5. Insert the two corresponding securing bolts (B) and washers (C) and lock these bolts by using the 13 mm ratchet wrench.

6. Repeat steps 4 and 5 to install the other egress bar on the other side of the bed frame.

Removal

Perform the installation procedure in reverse order.

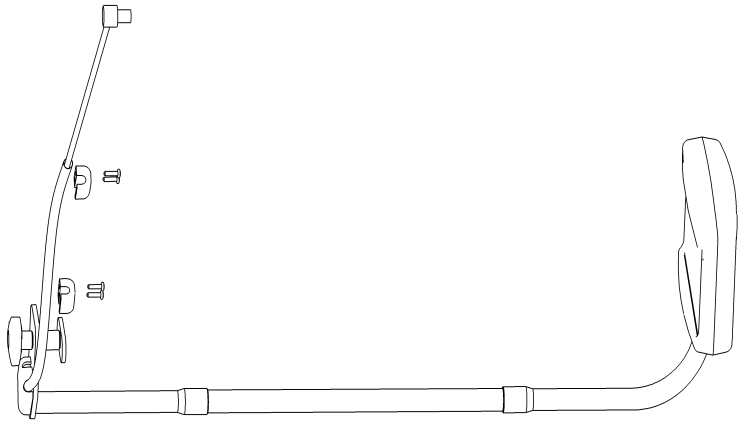
7.4 Control Panel on a Flexible Arm Kit - AD136A

This kit contains the control panel on a flexible arm and the parts that enable it to be installed on the bed.

The control panel on a flexible arm kit includes the following:

- One contol panel on a flexible arm
- One knob securing screw
- Two cable/plastic sleeve supports
- Four cable/sleeve securing screws

Figure 7-7. Control Panel on a Flexible Arm



1680_744

Identification: (see figure 3-1 on page 3-3)

Time required: 15 min

Number of people: 1 (plus 1 occasionally)

Possibility of intervening with patient on the bed: No

Tools required: Medium phillips head screwdriver

Installation

1. Apply the brakes, adjust the bed to high position, the sleep surface horizontal.
2. Adjust the head section to high position, the siderails to high position and remove the headboard.

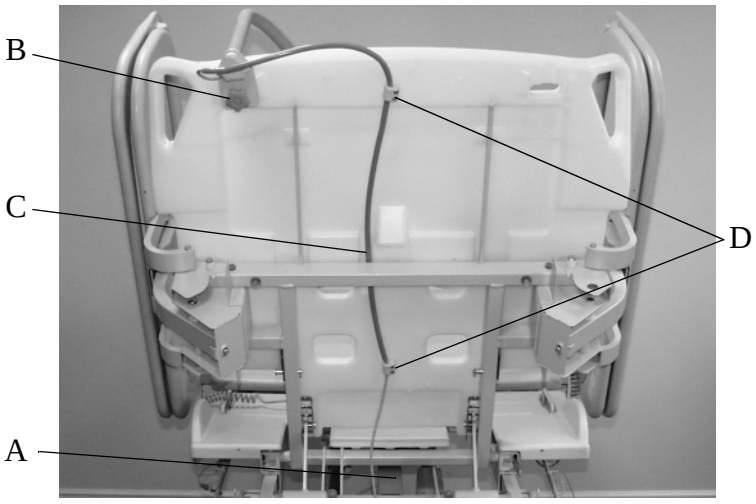
SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

3. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control unit. If this is not the case, wait for about one minute until the battery mode is deactivated.

4. Remove the hard surfaces of the seat and thigh sections (refer to procedure 4.1).

5. Remove the cable cover (A) of the central rail of the bed frame (see figure 7-8 on page 7-12).

Figure 7-8. Installing the Control Unit on Flexible Arm



6. Position the arm of the control unit with respect to the hard surface and fit the supporting knob screw (B) with its yoke. Tighten the assembly.

7. Press slightly on the centre of the headsection hard surface so as to move it away from the HS frame and pass the connector through the specific notch (C).

8. Install the two supports (D) and tighten the corresponding screws with the medium Phillips head screwdriver.

9. On the right hand or left hand lateral caregiver unit, note the connection socket available for the control panel on a flexible arm socket (A) (according to the control pendant position)(see figure 4-6 on page 4-11).

10. Open the cable track located under the righthand or lefthand central crossbar (B) of the bed frame.

11. Position the cable of the control panel on a flexible arm in the central rail of the bed frame then in the cable track situated under the central crossbar (B) by leaving as much play as possible on the cable at the level of the HS articulation.

12. Close the cable track situated under the central crossbar (B) of the bed frame.

13. Replace the cable cover (A) on the central rail of the bed frame (see figure 7-8 on page 7-12).

14. Perform the “Function Checks” on page 2-6 of this manual.

Removal

Perform the installation procedure in reverse order.

7.5 Hilow Pedal Kit - AD137A

This kit contains the two hilow pedals and the parts that enable them to be installed on the bed.

The hilow pedal kit includes the following:

- Two hilow pedals
- Two cable tracks
- Two securing bolts

Identification: (see figure 3-1 on page 3-3)

Time required: 15 min.

Number of people: 1

Possibility of intervening with patient on the bed: Possibility of intervening with patient on the bed: yes

Tools required: Small screwdriver
13 mm ratchet wrench

Installation

1. Apply the brakes, adjust the bed to high position, the head, thigh and foot sections horizontal. Lift the foot siderails.

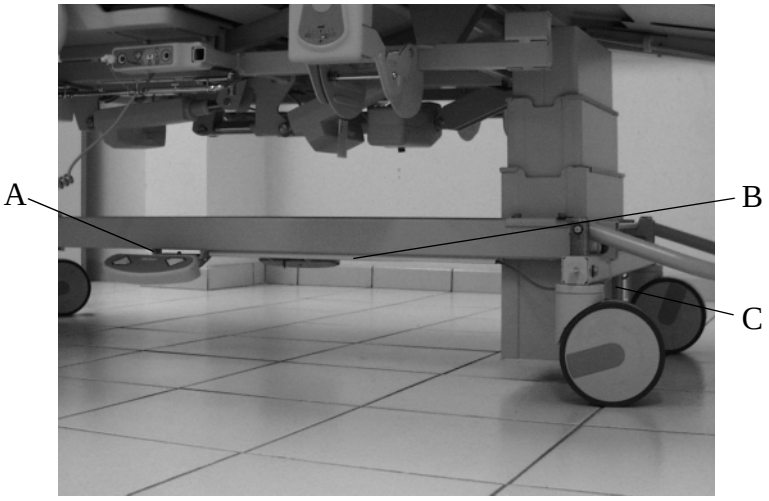
2. Unplug the power connector from the power outlet. If the bed has a battery, ensure that no LED is lit on the control unit. If this is not the case, wait for about one minute until the battery mode is deactivated.

SHOCK HAZARD:
Electric current flows through the connections when the bed is powered. Disconnect from the power outlet, otherwise personal injury could occur.

3. Free the foot frame cover (A) depending on the caster to be replaced. Note that it is secured by clips at each end (see figure 4-25 on page 4-51).

4. Position each pedal in its support (A) and fit the corresponding bolts by using the 13 mm ratchet wrench (see figure 7-9 on page 7-15).

Figure 7-9. Installing the Hilow Pedal



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5. Position the two cable tracks supplied on the two tubes (B) of the base frame between the pedals and the foot HL column.
6. Remove the two covers (C) situated at the base of the column.
7. Open the cable tracks situated on the base frame tubes and on the foot crossbar using the small screwdriver and insert the pedal cables. Close the cable tracks.
8. Connect the pedal cables to the connector provided at the base of the foot HL column.
9. Refit the two covers (C) to the base of the foot HL column.
10. Perform the “Function Checks” on page 2-6 of this manual.

Removal

Perform the installation procedure in reverse order.

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